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SUPPURATION

AND

SEPTIC DISEASES.

BY

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VIII—1

SUPPURATION AND SEPTIC DISEASES.

CHAPTER I.

In reprinting these lectures I have added a few notes where I thought that further facts might be of interest, but the lectures themselves have not undergone any, or only a few verbal, alterations. In these lectures my aim was not so much to detail original work—which is, I think, best given in special papers, in which the methods employed and the results obtained can be gone into in detail—as to summarize and give uniformity to the knowledge which has been gained by the work of many observers during the last few years. Of late years a certain antagonism has arisen between bacteriologists working in laboratories and clinical observers who do not possess a practical knowledge of bacteriology. The bacteriologist directing his attention mainly to the bacteria, has tended unduly to overestimate the importance of these organisms; while the clinician, looking at the matter from the side of the body, has realized that an infective disease is a complex process, and has too often underestimated the importance of the causal organisms. As one who has studied the subject from both points of view, though more from the clinical than the bacteriological side, I have naturally directed my efforts to the attempts to reconcile the apparently conflicting evidence, and in the present lectures I have tried to estimate, as fairly as I can, the relative importance of the various factors which come into play in the production of suppuration and septic diseases. When all has been done we shall see how much we are still in the dark as regards these processes; but it is only by summing up our knowledge from time to time that we can

realize what we have gained, what are the points which most urgently require elucidation, and what direction future investigations should take.

The history of this subject from the early publications by Sir Joseph Lister down to the present time is one of very great interest, as being the history of the groundwork of the great revolution in surgery of modern times, but it would take up more space than I have at my disposal. I may, however, indicate the three great landmarks in the development of our knowledge.

The first landmark of importance with regard to our present views on this matter is the first papers by Sir Joseph Lister on antiseptic surgery. At that time, and for some years afterward, little or nothing was known as to the different species of micro-organisms and their different effects, and consequently they were only spoken of in general terms.

Sir Joseph Lister's earliest views may be summed up as follows: It is the putrefaction of the discharges from a wound that leads directly or indirectly to suppuration and septic diseases; the causes of putrefaction are micro-organisms which enter the wound from without, for—with a few rare exceptions, such as osteomyelitis—suppuration does not follow injuries where the skin remains unbroken and healthy; hence, an essential part of the treatment of wounds must be to prevent the entrance of these organisms from without.

While the great majority of the cases treated on these principles supported his views, the absence of putrefaction and of suppuration and septic disease going hand in hand, cases every now and then occurred which led Sir Joseph Lister to see that this was probably not the whole truth. Thus, he found that the application of too much and too strong carbolic acid to a wound, instead of improving matters, was in some cases followed by suppuration. From this and similar observations he came to the conclusion that the irritation of the antiseptic itself, if sufficiently severe and long-continued, can cause suppuration. In other cases, again, he found that suppuration sometimes occurred when the discharge did not have free exit, and this he ascribed to nervous agencies brought into play by the tension thus excited. For these reasons he came somewhat later to the conclusion that there are three causes of suppuration in wounds, viz.: (1) Suppuration from

putrefaction of the discharges—by far the most frequent and severe form; (2) suppuration caused by the antiseptic employed—"antiseptic suppuration;" and (3) suppuration from tension.

At this period, and for some time later, the view was still held that it was the putrefaction of the discharges, or rather the organisms which caused the putrefaction, which led to the occurrence of suppuration; and the tests used to ascertain whether the antiseptic treatment had been successful or unsuccessful in its object, were—the smell of the discharge or dressings, the absence or presence of putrefactive odor, and, at a later period, the blackening of the protective where fermentation had occurred, due to the formation of sulphide of lead. Cases, however, occurred from time to time in which wounds suppurated without any reason for supposing that either tension or the irritation of the antiseptic were at work, and yet where there was no putrefactive odor and no blackening of the protective, and it thus became evident that in some cases, at any rate, the organisms which caused suppuration were not necessarily the same as those which caused putrefaction. It was the knowledge of this fact which led me, in my book on "Antiseptic Surgery," to use the term "fermentation" of the discharges from the wound, rather than the word "putrefaction," for I assumed that all organisms cause some alteration, and most of them some fermentation, in the soil in which they grow, and thus I left the question as to the exact fermentative action of the pyogenic organisms undetermined.

Important observations then followed in Germany as to the presence of bacteria in wounds treated aseptically. These observations were, however, always open to the objection that the aseptic treatment had not been properly carried out; but this objection was removed when, on examining wounds treated by Sir Joseph Lister, I found that in a certain number of them organisms were really present. I found that it was only, as a rule, when the dressings—carbolic gauze—had been left on for several days at a time that these organisms, which belong to the class of micrococci, made their appearance in the wounds. I have recently found that the organisms which usually appear are those forms of micrococci which are the most constant inhabitants of the surface of the skin, and

which are non-parasitic. It was only in a few instances that the more hurtful forms entered, and in these cases their presence was generally indicated by suppuration, etc. Bacilli are never found in wounds covered with carbolic dressings, provided the treatment has been carried out properly. The entrance of these cocci can be avoided by frequent dressings, and by washing the skin over and beyond the whole extent of the dressings when changing them. They gain an entrance by growing in the discharge beneath the dressing, and so spreading into the wound, and also by growing in the superficial but dead layers of the epithelium, which protects them from the antiseptic in the gauze.

About this time (1879) observations were also being made as to the presence of micrococci in abscesses. Billroth found micrococci in a large portion of the acute abscesses which he examined, and Recklinghausen, Klebs, and others had often found micrococci in the pus of acute osteomyelitis. I found, by cultivation in cucumber infusion, micrococci in a certain, though small, proportion of cases, and for that reason I was inclined at the time to look on their presence as more or less accidental.

The second great landmark was the research by Professor A. Ogston, of Aberdeen, on micro-organisms in abscesses. This research threw a great deal of light on this matter, and Ogston's results are the basis of the more recent work on the organisms of suppuration. He examined the pus from a large number of abscesses microscopically, and found that micrococci were invariably present in acute abscesses, and in a few instances in certain situations bacilli were also found. Ogston further described two different kinds of cocci under the terms staphylococci and streptococci, according to the grouping of the organisms, and he pointed out the frequent association of the former with closed abscesses, and of the latter with erysipelatous processes. He concluded from his experiments that these cocci were the cause of the abscesses, and also that erysipelas, pyæmia, and septicæmia were the work of the same organisms.

Ogston's statements were, in the main, soon confirmed by a number of observers, and shortly afterward Fehleisen demonstrated the streptococcus of erysipelas, and its causal relation to that disease. Following on this, Loeffler and Becher de-

scribed a coccus (really the staphylococcus pyogenes aureus) as the causal agent of acute osteomyelitis, and they were at first inclined to regard it as a specific organism, and different from those usually found in pus. This last conclusion, however, soon proved to be erroneous.

The third landmark is Rosenbach's work on the micro-organisms in infective diseases of wounds, published in 1884, a work which still forms the chief basis of our present knowledge of the subject. He demonstrated several different varieties of pyogenic organisms, studied their characteristics, and finally showed their causal connection with suppuration. Rosenbach's work has been amply confirmed by subsequent observers, and other pyogenic organisms have been found, and many facts added with regard to their mode of action.

CHAPTER II.

INTRODUCTORY REMARKS.

In studying the effects of pathogenic bacteria on animals, we frequently see great differences between the effects of the same bacteria on different species of animals, and even on the same species under varying conditions. Inoculate guinea-pigs with tubercle bacilli and we constantly produce a rapid and general disease, which has little or no tendency to remain localized, and no tendency to undergo spontaneous cure; we are therefore naturally tempted to look on the bacilli as the only noteworthy factor in the causation of the disease, and to think that with the discovery of the bacillus the etiology of the disease has been settled. On the other hand, if we turn our attention to man, we see that opportunities for infection with tubercle bacilli are frequently present without being followed by infection; that the disease assumes a variety of forms under a variety of external conditions; that it has comparatively little tendency to become generalized; and that it has a strong tendency to cease either spontaneously or under the influence of treatment not directed immediately against the parasites. It cannot be a matter of surprise if, under these circumstances, the clinical observer concludes that the etiology of the disease has not been solved by the discovery of the bacillus, or that he is inclined to regard the organism as a very insignificant factor in its causation, or even as a secondary, and perhaps unnecessary, accompaniment.

The fact is, however, that in these diseases we have two opposing forces before us—on the one side the bacteria, on the other the body; and these forces are by no means always equally matched; nor do they always bear the same relation to each other in different species of animals. In some animals the bacteria are more powerful than the body, the resistance on the part of the body being scarcely, if at all, evident; in other species of animals the same bacteria are much weaker

than the body, and if they succeed in entering the animal organism at all they only do so by the aid of other conditions; and when these conditions cease to act the bacteria again die out. In extreme cases these conditions, by determining the seat and exact nature of the resulting disease, are apt to give rise to the erroneous belief that they are the essential ones.

This is well illustrated not only by the example given, but also by the case of anthrax. Introduce a single anthrax bacillus into a guinea-pig and the animal dies with certainty of a general disease, with only œdema at the seat of inoculation. On the other hand, introduce anthrax bacilli into rats, and we have a very different result, and one which varies according to the age of the animal and the other conditions of the experiment. The result of the injection of a number of these bacilli into a young rat, for example, is that the animal becomes very ill, it may be, in some cases, even dies, while there is a production of sero-purulent fluid at the seat of inoculation. The older the rat, up to a certain point, the less are the general symptoms manifest, the thicker is the pus which is formed at the seat of injection, and the sooner do the anthrax bacilli die out.

In spite of these different results we must none the less admit that in each case the bacillus was the essential cause of the disease, the difference in the characters of the disease being due to differences in the strength of the opposing forces. In the case of the guinea-pig infected with anthrax, the bacillus is so much more powerful than the body that the symptoms of resistance on the part of the latter are completely obscured. In the case of the rats, on the other hand, the opposing forces are more or less equal in strength, and, consequently, other conditions, such as age, seat of inoculation, etc., come into play and modify the character of the disease.

Duclaux, in his work, "Le Microbe et la Maladie," mentions an excellent example of the part played by other factors in relation to infection. The itch of domestic animals is produced by an acarus which is almost visible to the naked eye; it lives in the superficial layers of the skin. According to the experiments of Delafond and Bourgingnon, the acarus, when placed on the skin of well-nourished and healthy animals, cannot take root or form colonies. Sheep cannot be artificially inoculated with scab, but if they are first submitted to unsuitable condi-

tions as regards nourishment and stabling, such as would debilitate them, the acarus can be very readily implanted, and it flourishes so long as the animals are kept in this unhealthy state. If, however, the nutrition of the animals is improved, if their stalls are cleaned and well aired, then, without any treatment against the acarus, the itch disappears and the animal becomes clean.

Another excellent example is that of pebrine and flachérie, pebrine attacking silk worms irrespective of their state of health or the existence of predisposition, and flachérie chiefly attacking worms whose digestive apparatus is weakened by previous disease or heredity.

In our surgical work we have to do with two diseases which illustrate in a very marked manner the action of the various conditions necessary for their production. These are: local tubercular affections, and suppuration with its allied diseases. I had at first intended to discuss both these diseases from this point of view, and such a discussion would have led to important deductions as regards treatment, especially in the case of the tubercular surgical affections; but when I came to put the material together, I found that it was far too great for the time at my disposal, and I therefore resolved to limit myself to a short sketch of the present state of our knowledge with regard to suppuration and septic diseases, with especial reference to the various conditions on the part of the body, and on that of the organisms, which are of importance in the commencement and continuance of these affections. And I may at once say that, as regards suppuration, I shall only refer to the acute form, the question of chronic suppuration being intimately bound up with that of surgical tubercular diseases, and differing greatly in its etiology and pathology from the other.

Description of the Pyogenic Organisms.—Before going into further details on this subject, it will be most convenient to glance briefly at the various organisms which have been found in association with acute suppuration. These organisms are distinguished from each other by their microscopical appearance, their characters on cultivation, and their effects on animals. The information obtained by means of the microscope is not much; in fact, beyond telling us whether we have to do with bacilli or with cocci, and whether we have to do

with streptococci or staphylococci, the microscope does not aid us. In order to obtain more precise information it is necessary to employ various methods of cultivation, and, fortunately, as some of the organisms produce pigment while others do not, as some liquefy gelatin and others do not, and so on, we get further information of great value as regards the species present. In some cases also it is necessary to resort to the study of their effects on animals, in order to ascertain the existence of any differential characters between the organisms present.

1. Staphylococcus Pyogenes Aureus.

This is the organism most commonly present in acute suppuration. As the name implies, the organisms are cocci which tend to arrange themselves in the form of bunches (Fig. 1). They grow readily at the ordinary summer temperature, but

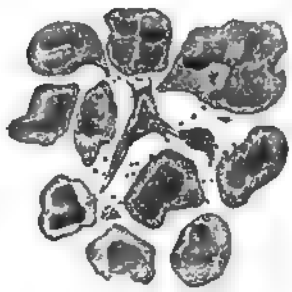

Fig. 1.—Staphylococcus Pyogenes Aureus (after Flügge)

most rapidly above 30° C. When grown in gelatin they soon cause liquefaction of that medium, with the development of an orange-colored deposit. When grown on agar kept at the body temperature, we see, even after twenty-four hours, a whitish or light yellow opaque layer at the point of inoculation, which soon becomes more distinct, and of a bright orange-yellow color. On potatoes it grows very readily, and presents the same appearance. These organisms peptonize albumen very energetically; they also give rise to a peculiar sweaty odor, like that of decaying starch. They retain their vitality in cultivations for a long time, and in the dry state they remain alive for, at any rate, some weeks.

Injection of these organisms into animals gives varying

results, according to the number injected and the other conditions of the experiment; but, in the case of rabbits, it is comparatively easy, on subcutaneous injection, to produce suppuration; on intravenous injection, to set up abscesses in the kidneys and also in other organs; and on injury to bone, to cause suppuration in connection with the injured part. Injection of moderate quantities of the cultivations into the knee-joints of rabbits usually causes acute inflammation with suppuration, and ultimately the death of the animals; and in the case of dogs, abscesses result, but not as a rule death. This organism is the same as that described in acute osteomyelitis, and at first supposed to be the specific organism of that disease.

2. Staphylococcus Pyogenes Albus.

This organism resembles the former in its conditions of life outside the body, in the character of its cultivations, and in its effects on animals, but it produces no pigment. As regards its effects on animals, it is generally stated to be less virulent than staphylococcus pyogenes aureus; but my own experience is that, on the contrary, it is rather more virulent.

3. Staphylococcus Pyogenes Citreus.

This organism, like the former, liquefies gelatin, and grows both at the body and the summer temperature. After growing for twenty-four hours on agar kept at the body temperature, the cultivations present a light yellow color, indistinguishable at that period from cultivations of aureus; the latter, however, soon become darker, and orange-yellow in color, while citreus remains of a light yellow or citron color. In both species the development of pigment only occurs where the colonies are in contact with air. The pathogenic properties of citreus are said by Passet to resemble those of aureus and albus, though it is not quite so virulent, abscesses following subcutaneous injection and injection into the knee-joint, while deposits in the kidney occur after injection into the veins. In my own experience these organisms have proved much less virulent than aureus or albus.

4. Streptococcus Pyogenes.

These organisms are also cocci, which are arranged in chains often of great length (Fig. 2). They grow very slowly on the ordinary culture media at the summer temperature, but with greater rapidity at the temperature of the body. On gelatin they form small colorless round colonies, but these do not spread to any appreciable extent on the surface of the gelatin. On agar kept at the body temperature, they have a

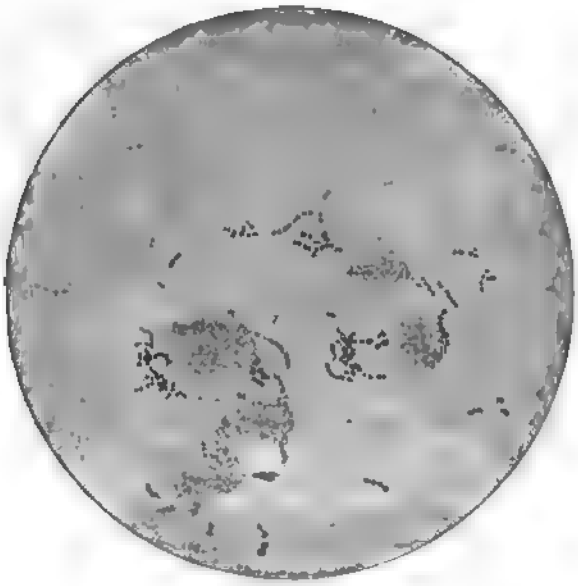

Fig. 2.—Streptococcus Pyogenes (from a photomicrograph, by Mr. Andrew Pringle).

tendency to grow in small points, which may attain the size of a pin's head; but, on the whole, the growth is very slow, and when sown on agar in the form of lines the growth does not, even after weeks, attain a greater breadth than two or three mm. They do not liquefy gelatin, but they exert an energetic peptonizing action in the absence of oxygen.

When injected subcutaneously into rabbits, unless considerable numbers are introduced, the result is only a slight and transient redness; when larger quantities are employed, it is said by some authors that small circumscribed abscesses, resembling chronic abscesses, are formed. When injected into

the knee-joint or into the pleura of rabbits, they at first cause slight inflammatory effusion, which, however, soon becomes absorbed without further bad consequences. Rosenbach was inclined to think that this organism differs from the form obtained by Fehleisen from cases of erysipelas, but that is a subject to which we shall presently allude.

When these streptococci are injected into the veins of rabbits after injury to the valves of the heart, endocarditis is set up. Loeffler isolated a streptococcus (*Sr. articulorum*) in certain cases of diphtheria, which caused, when injected into the blood stream, suppuration in various joints; and similar joint affections have been said to occur after injection of streptococcus pyogenes, but this observation is doubtful.

5. Micrococcus Pyogenes Tenuis.

This species is of rare occurrence, in fact Rosenbach only met with it three times. On agar it forms an extremely delicate, almost invisible, layer. The individual cocci are irregular in shape, and larger than the preceding forms. No experiments have been made on animals.

6. Rosenbach's Oval Coccus.

Rosenbach found an oval coccus in one case of acute suppuration, which rapidly liquefies gelatin and causes suppuration when injected into the eyes of rabbits. This organism has not been further studied nor has it as yet received a name.

7. Staphylococcus Cereus Albus.

This organism was found in abscesses by Passet. It forms a dull, white, wax-like layer on the surface of gelatin, and grayish-white patches on potatoes. Its name is derived from the appearance of the growth on gelatin, on which the individual colonies look like drops of wax. It is not pathogenic in rabbits.

8. Staphylococcus Cereus Flavus.

This organism was also found by Passet, and closely resembles the former, with the exception that the cultivations have a beautiful citron-yellow color. It is not pathogenic in rabbits.

9. Passet's Pseudo-Pneumococcus.

Passet has also found an organism in the pus of acute abscesses, which closely resembles Friedlaender's pneumococcus. This organism forms grayish-white semicircular elevations on the surface of gelatin, which may attain the size of pin heads. In the early stage of growth it is indistinguishable from Friedlaender's pneumococcus, but at a later period marked differences between the two can be made out, and that not only as regards the mode of growth, but also as regards the effects on animals. In the case of the pneumococcus, growth occurs not only on the surface of the jelly, but also along the entire length of the needle track; in the case of this organism growth occurs only at the surface, the organism being thus a typical aërobe. As regards the effects on animals, the pyogenic organism, when injected into the pleural cavity of mice and rabbits, causes pleuritis; and when injected subcutaneously, leads, in many instances, to the formation of abscesses in the same animals. On the other hand, Friedlaender's pneumococci are not pathogenic in rabbits.

10. Staphylococcus Flavescens.

This organism was found in an abscess by Babes, and occupies an intermediate position between aureus and albus. On nutrient jelly it forms a colorless layer, and liquefies the gelatin; on agar the growth becomes yellow after about eight days. It kills mice, sometimes causing abscesses, and sometimes, when in larger doses, septicæmia.

11. Bacillus Pyogenes Fœtidus.

Passet found this organism in an abscess in the neighborhood of the rectum. It is a bacillus which grows on nutrient jelly, forming a delicate white or grayish layer on the surface, but it does not liquefy the gelatin. Its growth on agar and potatoes has the appearance of a light brown glistening layer, which has a very foul smell; in milk this smell is not produced. Traces of the cultivation inoculated into mice do no harm; the injection of several drops causes septicæmia. Injection of about ten minims of an emulsion of the cultivation into a guinea-pig causes an abscess in which the bacilli alone were found. The organism was not pathogenic in rabbits.

12. Pneumonia Coccus.

In some cases of empyema occurring after acute pneumonia, the organism found in the pus is the pneumonia coccus described by A. Fraenkel, and regarded by him as by far the most frequent cause of pneumonia. On the other hand, in ordinary empyema, not in association with acute pneumonia, only the ordinary pyogenic cocci are present.

Other Organisms.—One or two other organisms have been described in acute abscesses, but as they are of no importance I need not take up time in describing them.

13. Gonococcus.

The gonococcus is constantly present in, and is undoubtedly the cause of, acute gonorrhœa. The cocci occur in pairs or groups, the individuals not being completely spherical, but flattened on their opposed surfaces. This appearance was at first supposed to be characteristic of the gonococci, but of late it has been found that a number of other cocci, which grow rapidly, present the same character. In gonorrhœal pus the cocci are frequently present in numbers in the interior of the pus cells, and Bumm regards this arrangement as peculiar to these organisms. They have been cultivated outside the body, though with great difficulty; in fact, Bumm was not successful until he employed human blood-serum. In this material the organisms form at the body temperature a delicate layer, which ceases to increase after about twenty-four hours, and must then be inoculated on fresh soil; they grow only on the surface of the serum. Bumm has definitely proved that this organism is causally connected with the disease by two observations on man, in one of which, the second generation grown on blood-serum, in the other the twentieth generation, were introduced into the healthy female urethra, and caused typical acute gonorrhœa.

As this is a specific organism only occurring in gonorrhœal inflammations, it need not be considered further in these lectures; it may be mentioned, however, that in a certain number of cases the ordinary pyogenic cocci are also present in the pus from acute gonorrhœa, and that it is just in these cases that suppurative bubo occurs, the pus from the bubo

containing the ordinary pyogenic organisms and not the gonococcus. Hence the occurrence of suppurative bubo in gonorrhœa is evidently accidental and due to mixed infection.

14. The Coccus of Erysipelas.

Although not a pyogenic organism, this coccus must be shortly referred to. Micrococci have been observed by many investigators in the lymphatic vessels of the skin in cases of erysipelas, in largest numbers at and beyond the spreading margin of the redness, but Fehleisen was the first who succeeded in obtaining cultivations of these organisms, and in demonstrating their causal connection with the disease. As has just been said they are present in the lymphatic vessels at and beyond the margin of the redness, but in the parts where the redness is passing, or has passed off, the lymphatic vessels and the tissues in their neighborhood become infiltrated with leucocytes, and the cocci rapidly die out. Fehleisen has succeeded in cultivating them on a number of media; on nutrient jelly they grow very slowly, and the individual colonies always remain small. They do not liquefy the gelatin, and the growth closely resembles that of streptococcus pyogenes.

If these organisms are inoculated on the ear of rabbits redness occurs, which spreads toward the root of the ear; and on making sections at the margin of the redness the lymphatic vessels are seen to be filled with the cocci as in man. Fehleisen has alsolutely proved that these organisms are the cause of erysipelas in man, by inoculating persons, the subject of incurable tumors, with pure cultivations of the cocci. Of seven individuals so inoculated six developed typical erysipelas; in the seventh case the patient had suffered from an attack of erysipelas only a few weeks previously, and was, in all probability, still protected from a fresh attack.

These inoculations may at first sight appear to be unjustifiable, but this is in reality not so, though they must not be undertaken unless there is a prospect of sufficient benefit from them to justify the risk incurred. It has more than once been observed and put on record that some forms of malignant tumors, too far advanced for operation, diminished considerably in size after an attack of erysipelas, and Busch has deliberately attempted to set up a curative erysipelas in such cases.

The details of Fehleisen's cases are interesting, and may be mentioned shortly. The method employed was to make superficial scarifications over the part, and then to rub in cultivations of the erysipelas coccus; erysipelas followed in six out of seven cases, the incubation period varying from fifteen to sixty-one hours. Case I. was a patient suffering from multiple fibro-sarcomata of the skin. After the erysipelas had run its course there was a partial degeneration of the tumors, but the therapeutic result was not marked. Case II. had been operated on thrice previously for cancer of the breast, and had a slight recurrence, but would not consent to further operation. The result in this case was the entire disappearance of the tumor after the erysipelas had passed off. Case III. was one of very extensive sarcoma of the orbit and the glands at the side of the neck. The result was that, though no diminution occurred in the tumor, the glandular swellings shrank to less than half their original size. Case IV. was a woman with extensive cancer of the breast, with numerous small nodules around the original tumor. Several of these nodules disappeared altogether, and a week after the cessation of the erysipelas the tumor was scarcely half its original size. Case V. was a patient with extensive lupus of the face. The lupus healed as the result of the erysipelas, with the exception of a few nodules in the neighborhood of the nostrils. These were afterward scooped out, and up to the time at which Fehleisen published no relapse had occurred. Case VI. was a woman with enlargement of the glands of the axilla and neck after a previous cancer of the breast. After the attack of erysipelas one of the tumors became soft and fluctuating, and ultimately discharged a white fluid. Case VII. was a patient with lupus, who had previously had an attack of erysipelas, and in whom the inoculation was not successful. Cases have also been recorded by other observers, in which erysipelas was set up by pure cultivations of these cocci, and in one or two instances with fatal results.

Relation of Erysipelas Cocci to Streptococcus Pyogenes.—An important question, and one which has been much discussed of late, is the possible identity of these erysipelas cocci with the ordinary streptococcus pyogenes; in fact a number of observers now assert that the organisms are the same, and that the different results depend on differences in the

other conditions, such as variations in virulence, dose, seat of inoculation, susceptibility of the host, etc. The earlier observers pointed out certain distinctive characters between the cultivations of the erysipelas organisms and those of the streptococcus pyogenes, but closer examination and comparison of the mode of growth of the two forms under similar conditions has failed to establish any constant differences between the two.

In the case of animals, chiefly rabbits, the statements as to the results of inoculation are very contradictory, for while some observers seem to have been able to make out very definite points of distinction, others have entirely failed to confirm their results. Thus Hajeh states that the erysipelas cocci, when inoculated into the ear of rabbits, cause a wandering inflammation, without any marked swelling at the seat of inoculation, and that they chiefly inhabit the lymphatic vessels, and are seldom found outside them; while the streptococcus pyogenes, inoculated in the same manner, causes wandering erysipelatous inflammation and the production of an inflammatory swelling at the seat of inoculation, and the cocci rapidly pass into the tissue, being found especially in the neighborhood of the blood-vessels, the walls of which they penetrate, and thus reach the blood. Hoffa also has obtained results of a somewhat similar character. He also notes that a doughy swelling, and ultimately a large inflammatory tumor, develops at the seat of inoculation of the streptococcus pyogenes, while the erysipelas cocci simply cause redness, without the development of any inflammatory tumor. On the other hand, several observers—Biondi, Passet, Bumm, Von Eiselsberg, and others—have entirely failed to establish any such differences in the effects on animals, and have come to regard these organisms as one and the same.

With reference to the attempt now being made to show that all these streptococci in infective processes in man are the same, Hueppe has made an important observation with regard to a streptococcus, which he obtained from a case of puerperal fever. This organism formed typical arthrospores similar to those of *leuconostoc*, and did not grow in nutrient jelly, but grew well in blood serum. It was thus specifically different from the ordinary streptococci.

It is thus evident that the whole question is still *sub judice.*

In any case these organisms are very closely allied, they are indeed probably varieties of the same species. But that we have to deal with absolutely the same organism, and that the differences in action do not depend on differences in their physiological characters, but simply on differences in the conditions under which they act, seems to me somewhat difficult of belief, and somewhat difficult to reconcile with clinical experience. It is quite possible, on the other hand, that two organisms may have the same microscopical characters, may grow in a similar manner in various culture media, and may have much the same effect on certain species of animals, and yet may not be the same; for when some other species of animal is tested, differences may be brought to light, the existence of which was not previously suspected. In proof of this, I need only refer to the example of chicken cholera, rabbit septicæmia, and swine fever, the organisms of which closely resemble each other, but apparently show differences when inoculated into certain species of animals. In the case of the organisms under discussion, it may quite well be that the differences between them are only brought clearly to light when they are inoculated on man.

As a matter of fact, in the cases where erysipelas has been produced in man by inoculation of pure cultivations only, organisms cultivated from cases of erysipelas have been employed, so that we have no absolute evidence as regards this matter; but there are facts which seem to show that inoculation of streptococcus pyogenes into the human skin does not cause erysipelas.

While there is no evidence that streptococcus pyogenes can produce erysipelas, it is asserted that the erysipelas cocci can cause suppuration. Thus, Hoffa obtained cultivations of what he considered to be erysipelas cocci from a case where suppuration occurred in the knee-joint beneath an erysipelas of the skin; and he has also seen suppuration in the fossa above the clavicle, in a student, where an erysipelas of the head spread over this part. Of course the obvious objection here is that these were cases of mixed infection with erysipelas cocci and streptococcus pyogenes, and that what he took to be erysipelas cocci were, in reality, the pyogenic streptococci.

For example, streptococcus pyogenes is not unfrequently present in closed abscesses, and when these are opened the

cutis is inoculated with the organisms; but so far as I am aware we have no evidence that erysipelas has ever resulted in such a case, or that a surgeon with a wound on his finger gets erysipelas from dabbling in pus containing streptococcus pyogenes. Rosenbach also mentions a fact which shows the action of streptococcus pyogenes on the human skin. He states that after opening an empyema which contained streptococcus pyogenes, a dense inflammatory induration, what was practically a boil, developed around the incision: erysipelas did not occur. Till, therefore, more definite evidence in favor of the unity of these organisms is produced than we at present possess, I am inclined to uphold the specific character of the coccus of erysipelas.

Occurrence of Pyogenic Organisms in Disease.—The diseases in which the pyogenic organisms occur are very various, in fact they are present practically in all affections accompanied by acute suppuration. Thus they are found in acute abscesses, boils, carbuncles, whitlows, spreading suppuration, acute osteo-myelitis, suppurative arthritis, suppurative peritonitis, empyema, ulcerative endocarditis, pyæmia, puerperal fever, the pustules of small-pox, etc.

Frequency of Occurrence of each Variety.—As regards the frequency of occurrence of the individual species, Zuckermann has put together the results obtained by a number of different observers in 495 abscesses, and he states that staphylococcus was present in 71 per cent of the cases, streptococcus in 16 per cent, the two organisms together in 5.5 per cent, and the remaining pyogenic organisms only exceptionally. As regards the pyogenic cocci individually, in 172 cases in which definite statements are made, we find that staphylococcus pyogenes aureus occurred alone, or in combination with other staphylococci, 123 times; and that streptococcus pyogenes was present alone 35 times, and in combination with staphylococcus, 8 times. Staphylococcus pyogenes albus occurred alone 25 times in 133 cases, and in combination with aureus also 25 times. The other pyogenic organisms occur comparatively rarely; thus, citreus was only found 7 times in 133 cases—4 times alone, and 3 times in conjunction with other forms; staphylococcus cereus albus was found 3 times in the same number of cases, and staphylococcus cereus flavus only once. Micrococcus pyogenes tenuis was found 3 times by Rosenbach in 39

cases (2 of these were cases of empyema, and 1 a case of acute abscess); the organism described by Passet as closely resembling Friedlaender's pneumococcus, was found in 2 out of 33 cases (in 1 case in an ordinary acute abscess, and in the other in an acute abscess after pneumonia); and the bacillus pyogenes fœtidus was only found on one occasion, viz., in an ischio-rectal abscess.

Action of Staphylococcus and Streptococcus.—The organism, therefore, which occurs most frequently in these diseases is the staphylococcus pyogenes aureus, and the next in frequency is the staphylococcus pyogenes albus. Both are associated with closed acute abscesses, also with boils, acute osteo-myelitis, etc., and albus is apparently associated with somewhat more severe inflammation than aureus; the combination of the two, in acute osteo-myelitis for example, seems to be particularly unfavorable. The streptococcus pyogenes is also frequently present, but it is especially associated with phlegmonous and erysipelatous processes, where the pus occurs in the form of infiltration of the tissue, accompanied by death of portions of tissue. It also occurs, as pointed out by Ogston and Rosenbach, in progressive gangrene, and is the chief organism of pyæmia, having been present in five out of six cases examined by Rosenbach.

Mastitis in women offers a good example of the different mode of action of these two species of pyogenic organisms. The abscesses in the mamma, which are caused by staphylococci, always begin in the deeper part of the organ and spread toward the surface, while in the case of the suppurations which occur in connection with streptococci the disease commences with a rapidly spreading redness of the skin, extending from some crack or fissure on the nipple, and the suppuration in the deeper parts follows this superficial affection. The explanation of these differences is that the staphylococcus usually spreads up the milk ducts and acts from their interior, whereas the streptococcus spreads along the lymphatic vessels, and its pathogenic action commences at the surface. This statement as to the action of the staphylococci from the interior of the ducts and acini, in the first instance, is not a mere theoretical deduction, for Bumm excised a portion of the wall of a commencing mammary abscess, and was able to demonstrate the presence of the cocci in the acini, and their penetration from thence into the interacinous cellular tissue (Fig. 3).

Kitt has specially investigated mastitis in cows, and has cultivated cocci from these cases differing from the cocci found in man; the injection of these cocci set up suppurative inflammation. Thus, in one case, he injected pure cultivations of one of these species of cocci into the milk ducts, with the result that on the evening of the same day the corresponding quarter of the udder became swollen, and by the next day was hot, swollen, hard, and very painful; the milk from that teat was yellow, turbid, and flaky, and contained pus cells.

These Organisms cause Suppuration.—We must now pass on to the evidence which leads us to believe that a causal connection exists between these pyogenic organisms and acute suppuration. In the first place they are constantly present in

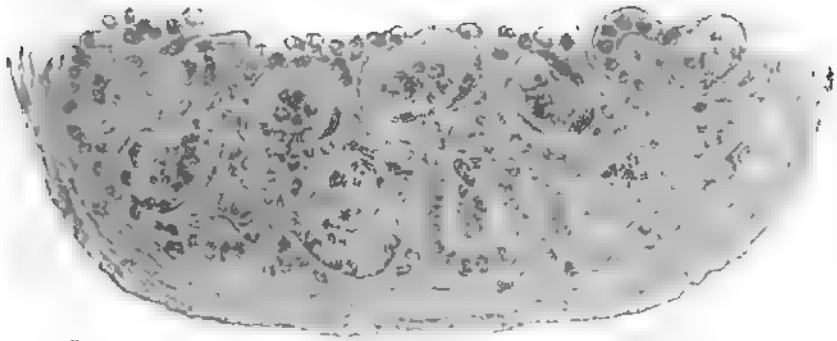

FIG. 3.—Section of the wall of a commencing Mammary Abscess, showing the presence of Staphylococci in the interior of the ducts and their penetration into the tissue (after Bumm).

acute abscesses and in suppurations generally, and, as has just been pointed out, certain species are generally associated with certain types of inflammation; thus, the association of streptococci with spreading suppurations, and of staphylococci with circumscribed abscesses, being constant, can hardly be accidental.

Experiments on Animals.—Numerous experiments have been made on animals which show that these organisms, when introduced under suitable conditions, can set up suppuration, and I have previously mentioned some of their effects on animals. The conditions necessary for infection are very various, more especially as the animals usually employed for the experiments are not very susceptible to the action of these organisms, but I need not refer to these conditions at present.

Professor Schütz has demonstrated the causal connection of a pyogenic coccus with strangles in horses. This disease occurs under two forms. In both it usually begins as a catarrh of the mucous membrane of the nose, and in the milder form this is followed by swelling and suppuration of the glands in the neck, more especially of the submaxillary glands, and of the glands around the pharynx. In the severe form metastatic abscesses occur throughout the body; in fact, the animal dies of a disease corresponding in all respects with pyæmia. On examining the pus from these abscesses, whether in the mild or the severe form, Schütz found a streptococcus constantly present in the pus which presented special characters, and which differed from any of the organisms which I have mentioned as occurring in man. He cultivated these cocci outside the body on the blood serum of horses, and was able to reproduce the disease, in a foal, for example, by injecting some of the cultivation into the nasal cavity. As a result of the injection the nasal mucous membrane became swollen and inflamed, and the animal suffered from a muco-purulent catarrh; this was followed by swelling and suppuration of the submaxillary glands, the pus from the abscesses containing the same streptococci. These organisms also set up suppuration when injected subcutaneously into mice.

One experiment will suffice to show that these organisms can cause suppuration in rabbits. Knapp has performed a number of experiments in connection with the process of healing of wounds of the eye in rabbits. A similar operation was performed on both the eyes of the same animal; on the one eye the operation was performed aseptically, the hands, instruments, etc., being carefully disinfected, and care being taken to exclude organisms during and after the operation, but no antiseptic was applied to the wounds: on the other eye the operation was performed in the same manner, but, after it was finished, the wound was infected with pyogenic cocci, usually with the staphylococcus pyogenes aureus. As a result, all the aseptic eyes, though very roughly handled, healed without a trace of suppuration, while almost all the other eyes were destroyed by suppuration, and only in those cases where the operation was superficial and not extensive did suppuration cease without complete destruction of the eye.

Experiments on Man.—Absolute proof of the causal con-

nection of these organisms with suppurative diseases has been furnished by experiments on man, of which we have three kinds. We have, firstly, a considerabte number of experiments where superficial abscesses have been induced by the introduction of organisms under the superficial layers of the epidermis; secondly, some where impetigo pustules, etc., have been caused by inunction of these organisms into the skin; and thirdly, experiments where abscesses have been caused in the subcutaneous tissue by subcutaneous injection of the organisms.

Superficial Inoculations.—As all the experiments in which superficial inoculations were made yielded similar results, it is unnecessary to mention more than one as an example. Take for instance one of Bockhardt's experiments. He introduced a trace of the mixed cultivations of aureus and albus into the cutis of his left forefinger; after forty-eight hours an abscess, the size of a small lentil, had formed and was opened, and the pus contained staphylococcus pyogenes aureus.

Inunction.—Garré's case of inunction of a cultivation of staphylococcus pyogenes aureus into the skin is probably well known, but I may mention it for the sake of completeness. He thoroughly cleansed the skin of his left fore-arm with distilled water, and taking a cultivation of aureus in gelatin, rubbed it well into the arm in the same manner as one would rub an ointment into the skin. For purposes of control, he rubbed a small quantity of sterilized agar jelly into the skin of his right fore-arm in the same manner, and it was noted that there was no wound or pustule on either arm. It may be said at once that the result on the control arm was *nil*. In the case of the other, a burning sensation began at the seat of inunction six hours later; this burning sensation became more intense, redness and swelling developed, and on the evening of the same day a number of pustules, the size of a pin's head, appeared, especially in connection with the hairs. On the following day these pustules had attained the size of a lentil, contained a small quantity of pus, and were surrounded by an inflammatory area. The inflammation increased in intensity, and on the fourth day the seat of inunction presented the appearance of an enormous carbuncle surrounded by a ring of pustules. Ultimately, more than twenty openings formed, discharging pus and portions of dead tissue.

Bockhardt performed somewhat similar experiments on himself, inoculating in the same manner a portion of the skin of his forearm, about the size of a five-shilling piece, the part having been cleansed and disinfected, and slightly scraped in places with his finger nail. The organisms used were a mixture of staphylococcus pyogenes aureus and albus. This mixture was rubbed into the arm at 4 P.M.; at 10 P.M., that is to say, six hours later, the seat of inoculation was slightly reddened and somewhat painful; fourteen hours after infection there were, at the seat of inoculation, twenty-five closely aggregated impetigo pustules, varying from the size of a pin's head to that of a lentil, a few, but not the majority of these, being traversed by hairs. These pustules contained the cocci employed, and by about the sixth day they had dried up and disappeared. Some days later a similar experiment was performed with the same mixture. The inoculation took place at six in the evening, the cultivation, mixed with sterilized salt solution, being rubbed into the outer part of the forearm. Next morning at 6 A.M. the seat of inunction was covered partly with impetigo pustules, of which he counted thirty-five, and partly with small slightly red patches; between 6 and 11 A.M. he saw twenty-five impetigo pustules form on these red patches before his eyes, most of these pustules being perforated by hairs. After eight days most of the pustules had dried up and disappeared, except two which had developed into large and painful boils, and for the next two or three months he was subject to a recurrence of impetigo pustules on the skin of his left forearm. As will be evident, the results in Bockhardt's cases were milder than in Garré's, and Baumgarten attributes this, and probably correctly, to the fact that Bockhardt rubbed in a much more dilute mixture of the organisms, and also a smaller quantity of them. That this may quite well account for the differences will be evident when we come to consider the question of the dose of organisms.

Bockhardt defines impetigo after Wilson as a pustular eruption, which appears at once as pustules on the skin, not being preceded by nodules or vesicles. These pustules appear suddenly, are generally small and do not enlarge, soon dry up and form crusts, have often a hair in their middle, and the skin in their vicinity is not altered, or only slightly reddened. They may occur anywhere except where there is much hair;

in such situations, Bockhardt thinks that if the same cause acts, sycosis will result. In Wilson's impetigo he has always found staphylococcus pyogenes aureus and albus, and the same organisms are present in boils; in fact, Bockhardt holds that the impetigo pustule is often a forerunner of a boil, for it is often situated on and precedes it.

Experiments have also been performed by Zuckermann with similar results.

Subcutaneous Injection.—Bumm injected pure cultivations of what was apparently staphylococcus pyogenes aureus into the subcutaneous tissue of his own arm, and into the arms of two other persons. The cultivations were mixed with a few drops of salt solution before injection. On each occasion an abscess developed, which varied from the size of a pigeon's egg to that of a man's fist, according to the time which elapsed before it was opened, and these abscesses contained large numbers of the organisms employed.

Anatomy of Abscess.—As regards the mode in which an abscess is produced by these organisms, a considerable number of facts have recently been obtained from the examination of parts after infection. Where the organisms are circulating in the blood, and become deposited in the smaller capillaries in the form of plugs, as is seen in pyæmia, the first effect is the change in the tissues, termed by Weigert "coagulation necrosis," and figured by me in a paper on "Micrococci in relation to Wounds, etc.," published some years ago (Fig. 4). On staining sections of tissue in which these plugs are present with the ordinary aniline dyes, it is found that, while the mass of organisms is intensely stained, and while the nuclei in the greater part of the section have become well colored, there is a ring of tissue around the central mass of organisms which does not take on the stain, and which presents a homogeneous translucent appearance; this ring evidently results from the action of the concentrated products of the micrococci, the tissue being brought into the condition of coagulation necrosis. After some hours a second ring appears at a greater distance from the mass of organisms, this ring, being composed of a dense layer of leucocytes, apparently collecting where the chemical substances are more dilute, and do not interfere with the life of the cells. As time goes on, the intermediate translucent layer becomes infiltrated on the one hand with cocci from

the central plug, and on the other hand with cells from the outer ring; and the original tissue rapidly disappears, probably in part as the result of the peptonizing action of the cocci. At the same time the fluid effused does not coagulate, probably also on account of the peptonizing action of the cocci on the fibrinogen, and thus we come to have a central collection of fluid containing leucocytes and micrococci, surrounded by a wall of leucocytes and cocci—in other words, an abscess.

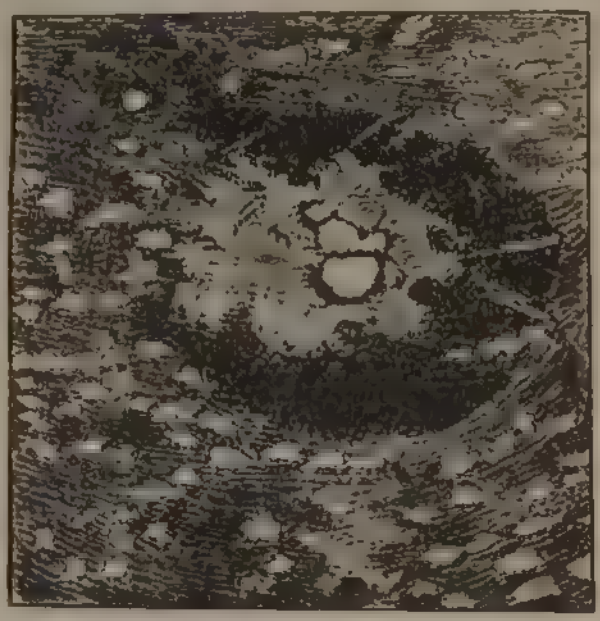

FIG. 4. Section of the Kidney of a Rabbit, showing a central mass of micrococci surrounded by a clear necrotic area, and further out by a ring of leucocytes. (From a photomicrograph by the author.)

When the cocci spread into the surrounding tissue after injection, from wounds in the skin, etc., they apparently at first frequently follow the course of the lymph channels. In the case of injections, as in Bumm's cases, we find at the seat of injection a central mass presenting a yellowish appearance, due to the presence of large numbers of leucocytes and cocci infiltrating the injured parts, this central yellow mass being surrounded by an inflamed area in which are also leucocytes

and micrococci. At the margin of the inflamed area the cocci are seen to be multiplying and penetrating into the surrounding tissue in all directions, the mode in which they spread varying according to the density of the tissue; thus where the tissue is fairly dense, they spread in masses, while in the loose tissue they form small groups and chains of four to six members. The cellular tissue attached soon loses its fibrous appearance, the fibrillæ swelling up and a homogeneous mass forming, this mass ultimately undergoing liquefaction just as in the case previously described. Beyond the area of infiltration with organisms, a layer of leucocytes is formed, but at first this layer does not seem to be able to oppose the spread of the organisms. In rabbits, however, after about the third, and more especially the fourth day, their spread begins to be limited, and the zone in which the cocci are penetrating into the tissue becomes thinner. In rabbits, by the ninth day, the tissues have, as a rule, completely got the upper hand, and the micrococcal growth is surrounded and limited on all sides by a layer of leucocytes.

In the case of Proteus vulgaris, which causes abscesses in rabbits, and of the bacillus of chicken cholera, which causes abscesses in guinea-pigs, there is usually a mass of necrotic tissue in the interior of the abscess, possibly left undissolved on account of their feeble peptonizing power.

The sequence of events in man is quite similar, but, as a rule, the cocci become inclosed more quickly than in rabbits. I should say that I have been speaking here of the effects of the staphylococci; the mode of spread and action of the streptococci is, as Ogston first pointed out, and as will be afterward mentioned, somewhat different, and apparently the differences bear some relation to the differences in peptonizing power of these two species of organisms.

As regards the mode in which the cocci act on the skin, for example in the experiments made by Bockhardt, the following seem to be the facts. The points at which the pyogenic cocci penetrate into the skin, are the ducts of the sweat glands, the orifices of the sebaceous glands and hair follicles, and portions of the skin where the protective epidermis has been scratched or destroyed. If micrococci penetrate by one or other of these paths into the skin, they multiply either in the wall of the ducts of the sweat glands and the adjacent part

of the Malpighian layer, or they penetrate into the external root sheath and into the Malpighian layer at the orifice of the hair follicles, or they develop at some part of the Malpighian layer which has been deprived of its epidermic covering. They multiply rapidly at the seat of infection, and set up violent suppurative inflammation in the neighboring papillæ. The violence of this inflammation is evident from the rapidity with which the pustules appear after inunction. As a rule, when the micrococci only set up impetigo pustules, they do not spread beyond the epidermic tissue; if they do so, we have the conditions necessary for the production of an abscess in the skin. This, however, generally only occurs after coarse mechanical injury to the skin. A boil develops especially from the impetigo pustules which have formed in connection with the hair follicles or with the orifices of the ducts of the sweat glands. After the micrococci have entered these parts and set up the impetigo pustules, they gradually spread in the wall of the ducts until they reach the end of the sweat gland or sebaceous or hair follicle. Coagulation necrosis occurs around them, and violent inflammation is set up in the vascular tissue surrounding these ducts and glands, with the result that a layer of leucocytes is formed like a wall around the affected epithelial tissue. As the necrosed wall of the duct or hair follicle becomes infiltrated with pus cells, the core of the boil is formed, pus collects around the core, and ultimately the skin gives way and it is expelled.

Can Suppuration occur without Micro-organisms?—Although it is thus evident that these organisms can cause suppuration, a very important question, and one which has been much debated, still remains for consideration, viz., whether suppuration can occur without the action of micro-organisms.

Absence of Organisms in acute Abscesses.—It is only in a very few instances that pyogenic organisms have been missed in acute abscesses. In two cases of suppurating hydatid cysts, Rosenbach did not see any organisms, but they have since been found in a number of similar cases which have been examined. In cases of suppurating bubo after soft chancres, organisms have not been found in a considerable number of instances, especially in those which become chancrous surfaces after being opened, while in other cases the ordinary pyogenic cocci have been present. In the former case, however, the

abscess is without doubt caused by the virus of soft chancre, a virus which is in all probability of a bacterial nature, but which has not as yet been satisfactorily demonstrated. As this is the case, it can hardly be a matter of surprise that organisms have not been found in a certain proportion of these buboes, and that, under certain circumstances, pyogenic organisms are present is only what we should expect as the result of the mixed infection which is so apt to occur. Although, therefore, organisms have not been found in some of these cases, we cannot conclude that none are present. With these exceptions, we always find that acute suppurations, occurring naturally, are associated with the pyogenic micro-organisms.

De Luca states that he has isolated very small cocci which produce soft chancres, and which he looks on as the virus of the disease. This micrococcus ulceris is a typical aërobe, and he explains the fact that these buboes are not infective till two or three days after they have been opened, by supposing that it is not till the access of air has been permitted for two or three days that the organism attains its full activity. If this be so, it is an argument against free incision into these buboes.

Experiments on Animals.—Numerous experiments have been made to see whether it is possible that suppuration can occur as the result of injuries of a mechanical or chemical nature without the intervention of micro-organisms. As a result it may be regarded as settled, in the case of the lower animals at any rate, that mechanical injuries, though frequently repeated, cannot of themselves cause suppuration; and, as a matter of fact, the whole discussion at the present time is limited to the effect of a few acrid chemical substances, viz., croton oil, ammonia, and oil of turpentine.

With regard to these substances, a great number of investigations have been made with contradictory results. On the one hand, a number of observers state that one or all of these substances can cause suppuration in animals. I myself came to the conclusion some years ago that croton oil could cause suppuration in rabbits. Omitting the earlier experiments, which were not free from objection, I may mention the method which I ultimately adopted, with the view of excluding all possible contamination with micro-organisms. I took

a mixture of equal parts of croton oil and olive oil, sterilized it, introduced it into sterilized glass capsules, which were then sealed at both ends. An incision was made antiseptically in the muscles of the back of a rabbit, and the tube introduced into the muscles; the wound was then stitched with catgut, and an antiseptic dressing applied. The result was, that in a certain number of cases the wound healed by first intention, and the glass capsule remained imbedded in the tissues as an unirritating foreign body. After a certain time had elapsed, the capsule was broken by slight pressure against the spine, and thus the croton oil was brought into contact with the tissues. In one experiment performed in this way the tube was broken fifty-four days after its insertion, and the animal was killed twenty-seven days later. On making an incision into the part, a quantity of putty-like material was found. In another experiment, forty-five days elapsed between the operation and the breaking of the tube, and the result was the same, except that there was a much smaller quantity of this putty-like material. No organisms were present in either case. Councilman and others who have followed the same plan mention similar results, as do also other observers, such as Orthmann, Grawitz, and de Bary, etc., who have adopted different methods.

Curiously enough Councilman and I adopted exactly the same method independently of each other. Councilman published his experiments before I did, but mine were done some months before his. I performed several preliminary experiments with goldbeaters' skin, etc., before I took to the glass capsules; and the reason why I diluted the croton oil with olive oil was, that I found that if I used the pure croton oil, the animals were apt to die of poisoning a few hours after the tube was broken.

Orthmann states that he has caused suppuration in dogs by the injection of considerable quantities of turpentine oil into the tissues, and that in none of the cases could micro-organisms be found, either microscopically or by cultivation.

Grawitz and de Bary also state that turpentine causes suppuration in dogs, and that large quantities of ammonia do the same. These experiments, however, require careful repetition.

On the other hand, we have a number of experiments care-

fully conducted by a number of independent observers, in which no suppuration has followed the introduction of irritating chemical substances. Thus Straus took especial care that organisms should not be introduced along with the material injected, by cauterizing the surface of the skin at the seat of injection, so as to destroy the organisms on it, and he is positive that these substances do not cause true acute suppuration. Perhaps the most valuable of these researches is that by Klemperer, who adopted Straus' method with still greater precautions. He states that he has failed to cause true suppuration by the injection of these substances, except in cases where micro-organisms were present at the same time. I may also mention a research by Ruijs, where the materials were injected into the anterior chamber of the eye, and where the effect could be watched. Here also it was found that if organisms are absent, suppuration does not follow the introduction of these chemical substances.

Christmas ("Annales de l'Institut Pasteur," 1888, No. 9, p. 469) comes to the conclusion that turpentine does not cause suppuration in rabbits, but that it does do so in dogs.

While it is a question how far we can look on this matter as quite settled, it is clear that in weighing the evidence most stress must be laid on the negative results. If a number of careful observers have entirely failed to produce suppuration by the injection of these irritating chemical substances, then those who have obtained a contrary result must either have brought some other factor unwittingly into play, or there must be some other explanation of the results.

The explanation of the positive results given by those who hold the opposite view is that organisms were really present in the pus, but were either missed from imperfect examination, or had died out before the abscess was opened. Speaking of my own results, I am positive that organisms were not present in a living state, and though it is quite possible that they may have been present at an earlier period, and have died out before I opened the part, I do not think that this is a satisfactory explanation, for other observers have examined the seat of injection at an earlier period than I did, and have likewise failed to find micro-organisms. Besides, the character of the disease induced is different from that caused by micro-organisms; in the latter case we have a progressive

suppuration, an abscess which goes on spreading, whereas those who speak of suppuration occurring after the introduction of croton oil, etc., state that it is not a progressive suppuration, and does not resemble that caused by micro-organisms.

On the other hand, it seems to me that we are possibly disputing about the same thing, that what the one set of observers calls pus, the other set looks on as fibrinous exudation, for Klemperer, Ruijs, and others, speak of the occurrence of fibrinous exudation containing many leucocytes as the result of their injections. Certain it is that after the injection of these chemical substances, true creamy pus is not obtained unless micro-organisms are present; the most that one gets is a collection of putty-like material; and it becomes a question whether this putty-like material may not simply be a further change in what has been found at an early stage, and has then presented the appearance of fibrinous exudation. Klemperer states that, on examining a part into which croton oil has been injected, the tissues at the centre of the irritation are of a yellow color, being infiltrated with fibrinous exudation and large numbers of leucocytes. Where the pyogenic organisms act, their peptonizing action rapidly dissolves this original tissue, and prevents the coagulation of the fresh exudation, and thus a cavity containing fluid pus is produced. On the other hand, where these organisms do not act, there are still grounds for believing that the tissues themselves can, very slowly, it is true, dissolve and remove the dead material, and thus we may quite well find, as the result of the prolonged action of the living cells on the extensive dead mass, a putty-like material which has been described as pus.

This seems to me to be the most probable explanation of these discrepant statements, but on this view we must admit that these irritating substances cannot cause true acute suppuration when micro-organisms are absent; the result which they produce is a different pathological process, corresponding more closely with the formation of chronic abscesses than with true acute suppuration. For the formation of acute abscesses we apparently require the presence of the peptonizing ferment produced by the micro-organisms, or at any rate, of a chemical substance which prevents coagulation of the exuded fluid. Thus we have to note that both Grawitz and Scheuerlen, the latter of whom denies the occurrence of sup-

puration as the result of the application of irritating chemical substances, state that they have succeeded in setting up abscesses by the injection of cadaverine, an alkaloid separated by Brieger from putrefying flesh; this substance is not only an irritant, but also prevents coagulation.

I mention this experiment, but I am not quite satisfied as to its accuracy, and should like to see it repeated carefully before I would lay great stress on it. In acute abscess formation we not only have the effused liquor sanguinis remaining fluid, but also solution of the original or of the inflammatory tissue. For this we require a chemical (peptonizing) ferment, and the micro-organisms probably act in that they are constantly producing ammonia and other products, which keep up the irritation of the tissues and cause effusion of leucocytes and plasma, and also a chemical ferment which causes solution of the tissue much more rapidly than could occur as the result of the action of the tissues themselves. Ruijs, in the experiments previously alluded to, where he injected turpentine, etc., into the interior chamber of the eye, describes the result as follows: At first the iris became hyperæmic and rapidly covered with a white exudation, which increased from day to day for about a week, and sometimes showed a few yellow points. This was clearly a fibrinous exudation adherent to, and infiltrating the iris. During the second week it became more yellowish in color, and was gradually absorbed. On examination of this material it was found to consist of fibrin and leucocytes, and the iris and cornea were infiltrated with round cells, but there was no destruction of tissue. Where cocci were introduced, true suppuration with destruction of tissue occurred.

As a matter of fact, the only situations where we have to consider the possible occurrence of suppuration without micro-organisms are the surfaces of wounds and the skin and mucous membrane. With regard to the possibility of acute suppuration from the irritation of antiseptics applied to wounds, I must confess that I have never yet seen true creamy pus coming from the surface of a wound without finding micro-organisms in it; and I suspect that the antiseptic can only increase the amount of exudation and the number of leucocytes, and thus cause at most a semi-purulent discharge. At the margin of the alembroth dressings, pustules are apt to form

on the skin, especially where the discharge is free, and these pustules contain a small quantity of sticky semi-purulent fluid, but no micro-organisms. This is the nearest approach that I have seen to acute suppuration in man without the action of micro-organisms.

It must be noted also with regard to these cases, that the process is quite superficial and leaves no scar; there is no marked destruction of tissue.

CHAPTER III.

In the last lecture we saw that these pyogenic cocci are constantly present in suppurative affections, that they can cause suppuration both in animals and in man, as evidenced by experiments and also by the microscopical observation of the changes which occur at the seat of infection, and that true acute suppuration does not occur naturally when these organisms are absent. It would therefore appear as if with the discovery of the pyogenic organisms, the etiology of acute suppurative affections was satisfactorily settled. This, however, is hardly the case, for the following considerations among others render it evident that, in most cases, other factors in addition to the micro-organisms, must come into play.

Other Factors usually Necessary.—Thus we find a great variety of morbid processes caused by the same organisms. The staphylococcus pyogenes aureus can set up a superficial inflammation of the skin, a boil, an abscess, acute ulcerative endocarditis, or even pyæmia; and the streptococcus pyogenes causes sometimes phlegmonous inflammation, sometimes peritonitis, sometimes puerperal fever, and sometimes pyæmia. Then, again, we have the fact on which I have not as yet dwelt, that, in order to produce these suppurative affections in animals, various conditions, such as the injection of large numbers of the micro-organisms are essential.

That these organisms are not of themselves able in most cases to set up suppurative diseases is evident also from the fact that they are frequently present in the blood without producing any suppurative affections. Thus Ogston states that in cases of septicæmia in man, the micrococci are present in the blood, and are excreted in a living state in the urine, and that without giving rise to secondary abscesses. Ogston's statement as to the presence of cocci in the blood has been confirmed by Von Eiselsberg, who examined the blood of almost all the cases in Billroth's clinique which were suffering from septic fever, and was able to demonstrate the presence

of staphylococci and streptococci, most frequently of staphylococcus pyogenes albus, in the blood, and yet apparently no abscesses formed. In the case of acute osteo-myelitis also, Garré has found the pyogenic staphylococci in the blood, although the patients did not suffer from abscesses in more than one situation. In connection with acute osteo-myelitis, perhaps the most interesting observations, as showing that these organisms may exist in the blood without doing any harm, are those in which children have been born suffering from this disease, while the mothers, through whose blood only the organisms could have come, have apparently been in good health. As an example of this, I may mention the following case published by Rosenbach in a paper on acute osteo-myelitis.

E. A., aged thirty, was delivered of her fifth child in June, 1858. She had been married ten years, and all her other children were living and healthy when born; she was not aware of having suffered any fright or injury to account for the disease in the child's leg. The latter, a full-grown boy, was born dead at full time, and had apparently been alive quite recently. Attention was at once drawn to the right leg, which was swollen, and showed distinct fluctuation both in front and behind. Immediately below the patella there was a bulla on the skin, the whole leg had a marked erysipelatous character, and on making an incision, a large quantity of pus was evacuated, and it was found that the greater portion of the soft parts of the leg was destroyed, and that there was scarcely any muscular substance to be seen. Further investigation showed that almost the whole of the periosteum of the tibia was detached, and the bone was in a state of necrosis. At the lower part, a small portion of the periosteum was inflamed, but still adherent to the bone; at the upper part the epiphysis of the tibia was almost entirely separated from the shaft, and was only connected with it by a few membranous threads.

Then we have a very interesting paper by Escherich on the presence of pyogenic cocci in the milk of women suffering from puerperal fever. In a considerable number of these cases he demonstrated the presence of the same pyogenic cocci in the milk from both breasts, and there was every

reason to believe that the organisms had reached the milk from the blood; more especially there was an entire absence of any disease or ulceration of the nipple; and yet, in these cases, there were apparently no abscesses either in the mamma or elsewhere. Escherich's observations have been confirmed by Longard, and both of these investigators have made experiments on animals, which had just brought forth young, which show that very shortly after the injection of these organisms into the blood they appear in the milk.

Escherich examined the milk in nine healthy women without finding micro-organisms in it, and he likewise failed to find them in five cases where the fever was due to other causes than puerperal fever, such as phthisis, syphilis, etc. Of thirteen cases of general septic infection, one gave a negative result, in one bacilli were present, in one cocci were found only in the milk from one breast, and in ten the same organisms were present in the milk from both breasts; in none of these was there any excoriation of the nipple nor abscess in the glands. The prevailing organism was, in his opinion, staphylococcus albus (though their identity is denied by Longard), and in four cases aureus was found as well. Escherich believes that in these cases the organisms come from the uterine wound, pass into the blood, and are execreted with the milk.

These pyogenic cocci have also been found in the blood in various febrile diseases, and not necessarily in association with suppuration. Thus Loeffler found the streptococcus pyogenes, or an organism very closely resembling it, in the diphtheritic membrane in cases of scarlatinal sore throat, and he observed that in some cases these organisms penetrated from the surface into the body. Fraenkel and Freudenberg have also investigated the organisms of scarlet fever, and have found that the streptococcus pyogenes is present in the blood in a considerable number of cases, without, however, apparently giving rise to any suppurative or septic affections.

I need not go into further details to show that these micro-organisms do not necessarily of themselves set up suppuration and septic diseases when present in the body; in the following considerations, sufficient evidence of this will be brought forward.

Conditions necessary for Infection.—The conditions which are necessary to enable these organisms to live and act in

the body may be considered according as they chiefly affect the body, or according as they chiefly affect the microbe. We have also some conditions such as temperature, season of the year, locality, moisture, etc., which must be grouped under a third heading; for, with regard to these we do not know whether their influence is due to some action which they exert on the body, or to some effect which they produce on the microbe. In considering these conditions, it is not possible to draw a sharp line between the various groups, because a number of these conditions is almost always combined in the same case; but I shall, as far as I can, endeavor to avoid repetition, and at the same time to treat of the various facts under their chief headings.

Had time permitted I should have liked, before entering on consideration of these conditions, to have traced the fate of the pyogenic organisms in the body when they fail to get the upper hand. And we should have found that these organisms disappear in a very remarkable manner from the blood, that they are in fact apparently rapidly killed in the blood, or deposited from it in various tissues and organs, or possibly excreted through the various excretory glands. The rapidity with which some organisms disappear from the blood is very remarkable; it is, in many cases, a matter merely of minutes, certainly of an hour or two, and this disappearance of the organisms from the blood must be due to an active destructive action of the constituents of the blood on them; mere unsuitability of soil is not sufficient to account for the rapidity of the phenomenon.

That organisms are very rapidly killed in the blood was shown long ago by Traube and Gscheidlen, and in a paper published in the "Pathological Transactions" in 1879, I referred to experiments which I had made, in which I found that twenty-four hours after intravenous injection of bacteria into rabbits, the organisms had disappeared completely from the blood. Von Fodor investigated this matter more precisely, injecting fluids containing known species of non-pathogenic organisms such as bac. subtilis, etc., into the jugular vein, and making cultivations from the blood at intervals, varying from four hours to several days; and he found that where the animals were healthy, the organisms had markedly diminished in number in four hours, and had completely disappeared after

some days. Wyssokowitsch has gone into this matter very fully in a paper which is full of precise and interesting details. He found that the rapidity with which micro-organisms disappeared from the blood varied with the species employed, and also with the condition of the microbe, more especially whether or not it was spore-bearing. Thus, when moderate quantities of spirillum tyrogenuma, non-pathogenic and non-spore-bearing organism, were injected into the blood stream, they were found in greatly diminished numbers after five minutes, and had completely disappeared in seven minutes. In the case of other similar organisms, their disappearance was complete in less than four hours. Spores were rapidly deposited in the blood, but retained their vitality for several days; in the case of bacillus subtilis, a few were found alive even after seventy-eight days. They are apparently deposited in the endothelial cells of the small blood vessels, chiefly in the spleen. As regards the pyogenic organisms, the streptococcus pyogenes, which does not exert a pathogenic action when introduced into the veins of rabbits in small numbers, disappeared in forty hours, and was much reduced in number after seven hours: staphylococcus pyogenes aureus was still found in very small numbers after seven days, but their numbers had much diminished even after five and a quarter hours. From Wyssokowitsch's researches it is clear that, while part of the organisms die in the blood, part are deposited like particles of pigment in various organs; and this is not only the case with non-pathogenic organisms, but seems also to take place with pathogenic ones. Thus, anthrax bacilli injected in comparatively small quantities into rabbits, were found to have disappeared from the blood after twenty-four hours, but were present in large numbers in the spleen and liver. Where larger quantities were introduced they were still present in the blood after that time, and in any case they reappeared in large numbers at a later period.

We should also have seen that there is good reason for believing that these organisms may be excreted by the various excretory glands, although this is a matter about which there is still considerable dispute. That they are so excreted by the kidneys is shown by various observations; and this is an important point to remember, as probably explaining certain cases of pyelitis and bacteruria occurring in patients who

have never had any instrument passed, and whose ureters and bladders are perfectly normal; the occurrence of these cases being explained on the supposition that the organisms had entered the blood in a living state, were excreted by the kidneys, and afterward, as in the example of which I showed a drawing at last lecture (see Fig. 4) (see paper on "Micrococci in relation to Wounds, etc.," British Medical Journal, July, 1884) found a suitable pabulum in the urine, and grew in the pelvis of the kidney.

Wyssokowitsch and others deny the excretion of bacteria by the kidneys, and hold that they only appear in the urine after rupture of blood-vessels, say in the glomeruli, and the passage of their contents into the tubules. That this may be the usual sequence of events I do not deny, but I still think that bacteria may be excreted by the kidneys in some cases. Ogston states that he has found micrococci in the urine of patients suffering from septicæmia, although apparently these patients had no disease of the kidney or bladder. Again in pyæmia and various other diseases, for example in Ribbert's experiments with aspergillus, there is a marked tendency for the organisms to become located in the kidney, and this seems to me to point to some functional activity attracting and retaining the organisms. Ribbert found, in his experiments on the fate of the cocci of osteo-myelitis in the blood, that after twenty-four hours the cocci could be demonstrated in all the organs by Gram's method, chiefly in the liver, but that they subsequently disappeared from all the organs except the kidney. He also found in animals killed after six hours, that there were large numbers of cocci in the convoluted and straight urinary tubules. Ribbert also states that a bacillus which he investigated in this respect was excreted by the kidney, but did not grow in the urinary tubules. Philipowicz states that anthrax bacilli, and also glanders and tubercle bacilli, appear in considerable numbers in the urine of mice and guinea-pigs even where there is no lesion of the vessels.

As regards excretion from the mamma, I have referred to the observations and experiments made by Escherich and Longard; and these facts are of interest in connection with mammary abscess, as showing that the organisms which set up these abscesses may arrive at the gland from the blood, and either grow in the tissues or in the acini of the gland after

excretion; although, without doubt, the great majority of abscesses of the mamma are caused by the spread of the organisms inward, either along the milk ducts, or from cracks in the nipple.

Longard injected small quantities of cultivations of staphylococcus pyogenes aureus into the jugular veins of guinea-pigs, which had just been delivered of young. In one case he examined the milk, taken with suitable precautions, after four hours, and although he found a few cocci on microscopical examination, he was unable to demonstrate them by cultivation: they were, however, found after twenty-four hours. In another experiment Longard injected the organisms under the skin of a bitch, and here also they were present in the milk twenty-four hours later. In neither case was there any microscopical change in the mammæ. Escherich injected a mixture of albus and aureus into the left jugular vein, and he found that milk taken four hours later contained a pure cultivation of the white coccus. This animal had a retro-mammary abscess fourteen days later. In another experiment Escherich injected a large quantity of a similar mixture of organisms into the jugular vein of a bitch, and found cocci in the milk after three hours. When the animal died eight days later, capillary emboli of cocci were found in the mamma, and the cocci were also present in the tissue around the vessels. The rapid appearance of the cocci in the milk in these cases, and the absence of any apparent disease of the mamma, seems to me only explicable on the view that they were excreted by the gland.

We should also have seen reason to believe that the salivary glands, more especially the parotid, occasionally take part in this excretion of pyogenic organisms; thus again offering a possible explanation of the not infrequent occurrence of abscesses in the parotid gland after suppuration elsewhere.

It is, however, only right to say that some writers, Leyden for example, think that in these cases the cocci may have spread from the mouth along the salivary ducts, but this seems to me very unlikely. Hanau, however (reference in "Centralb. f. Bakteriologie," Vol. VI., No. 5) investigated five cases of secondary suppuration in the parotid, in which he concluded, from their position, that the organisms had spread into the gland along the duct from the mouth.

On the other hand, in a case of pyæmia with abscess in the prostate, Hanau came to the conclusion, likewise from the position of the organisms, that the abscess was due to excretion of the cocci from the blood.

Passet also found that cocci were excreted through the conjunctiva in the case of mice, and Longard is said to have confirmed this observation.

The study also of the exact mode in which the body carries on the battle with the micrcbes, more especially the study of the investigations which have been set on foot as the result of Metschnikoff's experiments on phagocytosis, would have furnished us with much interesting and suggestive material for consideration. And we should have seen what an important part the leucocytes play in the destruction of microorganisms, and in the limitation of inflammatory processes, although the evidence does not as yet seem to be sufficient to support Metschnikoff's idea that these cells act by taking up the organisms into their interior and there killing them.

Metschnikoff's first research, published in 1884, had reference to a parasite observed in Daphnis, the parasite belonging possibly to the class of yeast fungi. The asci containing the spores are apparently swallowed by the Daphnis, and, probably as the result of the action of the gastric juice, the spores become free, and being pointed in shape, pierce the wall of the intestine, and reach the interior of the animal. When this has occurred, a battle begins between the parasites and the blood-corpuscles, and every spore or portion of a spore which penetrates into the body cavity, is quickly surrounded by blood-corpuscles. The spores thus surrounded, apparently undergo degeneration; they become thick, irregular in outline, light yellow or brown and granular. The blood-corpuscles unite to form finely granular pale plasmodia, which exhibit amœboid movements, and contain the granular remains of the spores. When, however, too many spores reach the body cavity, or when for some other reason the spores remain uninjured, disease occurs, the spores germinate and are carried by the blood-stream over the whole body, and are deposited in those parts where the blood flows most slowly—for example, in the front part of the head and in the neighborhood of the tail; in these situations masses of fungus cells are formed. In another research, Metschnikoff has studied the relation of

anthrax bacilli to frogs. After introducing these bacilli under the skin of frogs, he states that the bacilli penetrate into the tissues and that a mass of lymphoid cells collects around the bacilli, and ultimately eats them up. (According to Cornil, this process can be readily observed by placing a little of the lymph from a frog on a glass slide under the microscope, and adding some anthrax bacilli. The lymph cells take up the anthrax bacilli into their interior, and the bacilli become granular and disappear.) The immunity of frogs against anthrax bacilli is probably due to the fact that the anthrax bacilli are not in a vigorous state at the ordinary temperature of cold-blooded animals. Metschnikoff has also extended his observations to erysipelas in man. He investigated seven cases of erysipelas, of which two died. In these two cases there were numerous cocci in the cutis and in the subcutaneous tissue, and the cocci were always free and not in cells. In those cases, on the other hand, which ended in recovery, the state of matters was quite different, the inflammatory infiltration was more marked, and the leucocytes frequently contained cocci, while others contained irregular granules, and others again were empty. Only a few cocci were present between the cells, along with small leucocytes which he terms "microphagocytes." There were also larger cells, which he terms "macrophagocytes," but these did not contain any cocci, and apparently ate up the microphagocytes. In the case of anthrax, Metschnikoff looks on the larger cells as the destructive agents, the smaller cells apparently not taking part in the process. Metschnikoff holds that animals which are immune against a certain disease, are those whose leucocytes can eat up the parasites, and that those animals which are not immune are those whose leucocytes cannot do this. He, however, apparently admits that pure phagocytosis is not always the whole process, for he has shown that bacillus anthracis becomes attenuated in the blood of immune sheep without having become inclosed in cells, and he thinks that the cells may act not only by intracellular digestion, but also by secreting injurious materials. He has further drawn attention to the fact that fever temperatures may act injuriously on the bacteria ("Fortschr. d. Med.," 1887).

Metschnikoff's views have been opposed by several observers, and Holmfeld points out that it is just in the case of

the most virulent diseases, such as mouse septicæmia and tuberculosis, that there is a marked tendency for the cells to take up the parasites, while, on the other hand, bacteria which are comparatively little dangerous for the animals, such as the pyogenic cocci, are almost never taken up by the leucocytes. Holmfeld has studied the behavior of anthrax bacilli in warm-blooded animals, for he does not think that Metschnikoff's experiments on frogs give a fair view of the state of matters. He has employed susceptible animals such as rabbits and mice, and also non-susceptible animals such as rats, and he has used both virulent and attenuated bacilli. In mice and rats, the place selected for inoculation was the root of the tail; in rabbits, the base of the ear. Great care was taken to purify the skin, and to prevent the entrance of other organisms. The part was examined after twenty-four hours, and usually twenty-four hours later. The following are in a few words the results of his experiments: When the virulent organisms are injected subcutaneously into rabbits and mice, œdema results, the fluid being clear and serous, and containing numerous bacilli, but no, or almost no, pus-corpuscles; nor do the corpuscles increase in number during the next twenty-four hours, and suppuration does not occur. In rats, on the other hand, there is always pus in the wound, its quantity bearing a relation to the virulence of the material introduced, and to the susceptibility of the animal inoculated; thus in young rats, which are more susceptible than old rats, there is a muddy sero-purulent fluid containing numerous anthrax bacilli and corpuscles, while the older the rat the more does the material approach pure pus. Subcutaneous injection of attenuated anthrax bacilli into rabbits caused, as Metschnikoff has also stated, a slight local inflammation accompanied by suppuration. At the seat of inoculation there is constantly a drop of thick pus. Holmfeld's observations led him to believe that the bacteria die as the result of a chemical biological action rather than by digestion in the interior of the cells. In insusceptible animals, the cells evidently play only a small part, for in the pus there are comparatively few bacteria in cells, the great majority are free in the fluid, and most of them are killed without ever having been taken up by the cells. The conditions were the same when virulent material was employed, in so far that a few cells also contained bacilli. In rats the bacilli die in the

pus in two to three days. Holmfeld also took pus, after twenty-four hours, containing living anthrax bacilli, and kept it in capillary tubes at 37° C., and found that in a day or two the bacilli were dead, although the cells had not taken them up. He concludes that the organisms are killed by some chemical material in the pus.

Wyssokowitsch explained the disappearance of the organisms which he injected into the blood-stream, not as the result of a battle between the leucocytes and the bacteria, but as the result of a battle between the bacteria and the endothelial cells of the capillaries in which he found the organisms deposited. The result of this battle is either that the bacteria die and disappear, or that the cells are killed by the bacteria, and thus furnish a nutritive substratum for their growth. With regard to these views Baumgarten, who also fails to be convinced of the truth of Metschnikoff's theory, points out that on Wyssokowitsch's own admission, only part of the bacteria were present in the cells, that others were free and adhered to the inner wall of the capillaries, and that probably, from the analogy with pigment granules, not a few were free in the parenchyma of the organs. Hence he cannot agree that the majority are killed within cells, and if this is not the case, then the question arises whether their inclusion in the cells has any significance at all in regard to the death of the organisms. He thinks that many species of bacteria die in the body simply because the peculiar constitution of the living material is unsuitable for their growth and development. It seems to me, however, that bacteria die too rapidly to allow of this explanation, for they do not die so quickly when their nutriment is exhausted outside the body.

Ribbert, in studying the death of fungi in the body, found that in the liver the sprouting spores of aspergillus were very quickly surrounded on all sides by a layer of leucocytes, while in the kidneys, muscles, etc., the inflammatory cell formation occurs relatively later. He explains the fact that in the liver, in this disease, the deposits of fungi are never so much developed as they are in the kidneys, muscles, etc., by supposing that, in the liver, the early formation of this wall of leucocytes prevents the access of nutrient material and of oxygen to the growing mycelium, thus to a certain extent starving and choking them. Baumgarten does not agree with this ex-

planation, for he cannot understand how, if this is the case, a similar effect is not produced on the microbes of pyæmia, tuberculosis, glanders, etc., and he thinks that if cells act at all, it is more likely that the fixed tissue cells are the active agents than the leucocytes.

The idea that disease is a battle between the tissue cells and the parasites was long ago upheld by Virchow, and in my book on antiseptic surgery I pointed out the great influence exerted by healthy tissues and blood clot in preventing the development of micro-organisms in wounds. It seems to stand to reason that something of this kind must occur, but whether Metschnikoff is correct in supposing that the digestive action of the cells is the important factor is quite another matter. When two forms of saprophytic bacteria are growing together, and one gets the upper hand, it does not do so by feeding on the others, but either by abstracting their nutriment or by forming products which are either directly poisonous to them or at any rate render the soil unsuitable for their growth. In the case of the body it may be that the organisms are killed by chemical substances given off by the leucocytes or the tissues, and not by inclusion and digestion in the cells. That they do disappear in the presence of leucocytes is evident from the facts which I have mentioned with regard to the relation of micrococci to the walls of abscesses.

I must, however, omit the consideration of these matters and pass on to the discussion of the conditions which enable or hinder these organisms to act; and the first condition, and an essential one, which we have to notice is, that an opportunity must be afforded to the organisms of resting for a time in the part in which they exert their action. If they are floating in the blood-current, they must be arrested at some part, and not only must they be arrested, but as we shall see, they must find at that spot conditions suitable for their growth.

Embolism.

Such mechanical conditions causing the arrest of organisms are brought about by embolism, thrombosis, injury, etc. The importance of arrest of organisms has been beautifully shown by Ribbert in some experiments which he performed with a pathogenic species of mucor. When the spores of

pathogenic aspergilli are injected into the blood, deposits are formed in various organs and also in large numbers in the various muscles. In the case of mucor, however, Ribbert noticed that while the spores when injected into the blood-stream gave rise to deposits in various organs, the muscles remained only slightly or not at all affected. On looking into the matter, it was seen that the spores of mucor were very small, much smaller than those of aspergillus, and Ribbert thought it possible that the reason why masses occurred in the muscles in the latter case and not in the former, was that on account of the larger size of the aspergillus spores they were caught in the capillaries of the muscles while the mucor spores passed through them. He therefore sought to increase the size of the mucor spores before their injection into the blood, and this he did by keeping them for a short time in a nutrient fluid at the temperature of the body. As a consequence, the spores swelled up and commenced to sprout, and when he found, under the microscope, that this had occurred, he injected the material into the circulation. The result corresponded entirely to his expectations, in contrast to the control experiments he found that in these cases fairly numerous deposits of fungi were present, not only in the organs but also in the muscles of the back and extremities.

Referring, however, more especially to experiments with the pyogenic organisms, we have several facts of a similar nature with regard to their action on rabbits. The injection of moderate quantities of staphylococcus pyogenes aureus into the circulation of rabbits is followed, as a rule, only by abscesses in the kidneys, the other organs apparently remaining unaffected; but a number of experiments which have been made, among others by Ribbert, on the production of myocarditis and endocarditis in these animals, have shown that abscesses can be set up in other organs if the pyogenic cocci are attached to gross particles which cannot pass the capillaries of these organs. Thus Ribbert was able to produce myocarditis by using a cultivation of staphylococcus pyogenes aureus on potatoes, if he took care in removing the cultivation from the surface of the potato, to scrape off also the superficial layer of the potato itself. If this mixture of potato granules and organisms was rubbed up with water, so as to form a fine emulsion, and then injected into the circulation, the result was

the production of deposits of organisms in the muscular tissue of the heart, as well as in other organs, leading to myocarditis; if the particles of potato were very fine, only myocarditis resulted, but if they were coarser, endocarditis occurred as well.

Bonomé investigated nine cases of gangrene of the lungs in man, and found in three of them staphylococcus pyogenes aureus alone, in five staphylococcus pyogenes albus alone, and in one both organisms together. He tried to set up gangrene of the lungs in rabbits by the injection of these organisms into the circulation, but he failed to do so if only cultivations were employed. He succeeded, however, by taking pieces of the pith of the elder tree, breaking them up into very fine fragments, mixing these fragments with the cultivations of the pyogenic organisms, and then injecting this mixture into the jugular vein; the result was the formation of numerous deposits of cocci in the lungs leading, as shown last day, to extensive coagulation necrosis of large tracts of these organs, and, as a consequence, to extensive gangrene of the lungs. Injection of the fragments of the pith alone caused no effect.

In the same way, Ruijs found that if he injected a small quantity of a fluid cultivation of staphylococcus pyogenes aureus into the uninjured eyes of rabbits, suppuration did not result, and he concluded that the reason was that the cocci were carried away too quickly by the lymph stream; for if he soaked sterilized cotton threads in the cultivations, and then introduced portions of these threads into the anterior chamber of the eye, suppurative panophthalmitis occurred.

The last experiment that I shall mention is one by Pawlowsky, who found that by the simultaneous injection of sterilized cinnabar and of cultivations of staphylococcus pyogenes aureus into the circulation, he produced abscesses in various organs, in fact the typical picture of pyæmia.

Etiology of Pyæmia.—The great importance of these facts, in explanation of the etiology of pyæmia, will be at once evident. Whether cases of pyæmia occur in man, like those described by Koch in the case of rabbits, as the result of the growth of cocci in the blood, their entanglement of blood-corpuscles, and the consequent formation of emboli, we do not know; but it is very doubtful if this takes place, for the same cocci which seem to be the cause of pyæmia may, as we have

said before, be often present in the blood in considerable numbers, without causing abscess or embolism. It is easy, however, to understand that the ordinary pyogenic cocci may cause pyæmia, if they enter the blood attached to portions of blood clot or other solid material. This, in fact, is evident from the experiments mentioned, and thus the importance of thrombosis and embolism, as factors in the production of pyæmia, is clearly established. These emboli are not always necessarily emboli composed of detached portions of blood clot; in some cases probably, especially where the streptococcus pyogenes is the active agent, the organisms grow in the lymphatic vessels and the emboli are formed there, and arrive at the blood with the lymph stream. Probably in pyæmia other factors also come into play, such as a large dose of the organisms, general depression of vitality, possibly also greater virulence of the organisms; but it is evident from these considerations, and from the clinical and pathological facts, that embolism must play an important part. Pyæmia must thus be clearly distinguished from multiple abscesses, the so-called chronic pyæmia, where embolism does not probably play any part, but where cocci are able to circulate in the blood and are deposited in some part weakened by injury or other depressing cause.

Arrest of Organisms not usually Sufficient.—The mere arrest of these pyogenic organisms in the circulation, although an important factor, is not, however, as a rule, sufficient of itself to lead to the production of disease. This is very well seen in the case of rabbits. Inject a considerable number of pyogenic cocci into the circulation of a rabbit, and kill it within twenty-four hours, it will be found that masses of organisms are present in the capillaries of the lungs, and other organs of the body; but allow such an animal to live for forty-eight or seventy-two hours, and it will be seen on killing it, that the organisms have disappeared from the various organs, with the exception of the kidneys (Ribbert). Here we have evidence that although the organisms had been able to stick in the various organs, the other conditions were not favorable for their growth and action; and in the case of embolism, it is probable that the material to which the cocci are attached of itself aids their growth, by causing injury to the endothelium of the blood-vessels, and thus leading to the production

of a weak spot. And in the case of emboli composed of blood clot, the emboli are saturated with the products of the cocci, and are thus still more likely to injure the part. We must, therefore, pass on to the consideration of other conditions which aid the action of these organisms, and the chief of these is what we may roughly term general and local depression of vitality.

General Depression of Vitality.

That general depression of vitality can enable these organisms to live in the blood for a considerable time has been shown by a number of experiments. For example: I found in experiments on the presence or absence of organisms in the living tissues, that while organisms were absent when the animal was in a good state of health, yet if the vitality of the animal was depressed—say by administering large doses of phosphorus for some time—organisms could be found at times in the blood and tissues of the body. The same conclusion must be drawn from the following experiment. If, of a putrefying fluid not containing pathogenic organisms, varying quantities are injected into the circulation of animals, it will generally be found that after twenty-four hours the organisms have died out in those animals which received a small dose; while in those in which a larger quantity—say 1 c.cm.—was injected, in other words, in those whose vitality was depressed by the introduction at the same time of a quantity of the poisonous chemical products of these bacteria, organisms may still be found alive. This is a fact which has been confirmed by a number of observers, but as I shall have again to refer to experiments from which similar conclusions may be drawn, I shall pass on to what is much more important for the matter under discussion, viz., the result of local depression of vitality.

Wyssokowitsch has arrived at the same result in the research referred to in the paragraph on p. 40, and Von Fodor also found a difference in the rapidity with which organisms were destroyed in the blood according as the animals were healthy or otherwise.

The following striking experiment on frogs with the bacilli of Rauschbrand, shows very well the effect of general depression of vitality, and how the virus may remain in the body

without producing any effect till the vitality is diminished. Arloing, Cornevin, and Thomas placed frogs, some of which were inoculated with Rauschbrand and others not, in vessels containing water at 22° C. After fifteen to thirty hours the inoculated frogs died, and in the contents of the lymph sac the Rauschbrand bacilli were present in such numbers and of such virulence that their inoculation on warm-blood animals produced the ordinary results. The uninoculated frogs remained well. In contrast with this, frogs inoculated with Rauschbrand, and kept in cold water, were unaffected.

Local Depression of Vitality.

A number of experiments show that when the vitality of a part has been lowered by cutting off the blood-current for a comparatively short time, organisms grow in that part much more readily and luxuriantly than if the blood-stream had not been interfered with. To mention one or two examples: According to Cornil, a septic nephritis is readily obtained by ligaturing the renal arteries for some hours, and then after removal of the ligature, injecting pyogenic organisms into the blood.

Bonomé found that direct injection of staphylococci into the kidneys was followed by necrosis, and later by suppuration along the track of the needle, but this was more extensive and followed more quickly if the renal arteries had previously been temporarily ligatured for two hours.

Heubner's experiments on the artificial production of diphtheria also show in a very marked manner the effect of local depression of vitality as the result of cutting off the blood-stream temporarily. Heubner arrested the circulation in the fundus of the bladder for two hours by the application of a ligature to the vesical arteries; after removal of the ligature there resulted intense congestion and œdema of the submucous tissue, while, at the same time, as a consequence of the temporary inanition, the epithelial cells died; after the circulation was again restored there was a great exudation of blood plasma and cells, in fact, coagulation necrosis occurred on the mucous surface. Heubner found that if, at the same time that the circulation was restored, septic bacteria were injected into the blood, they accumulated in large numbers in

the affected part of the mucous membrane of the bladder, and set up extensive disease. In order to obtain these results, it is, however, necessary that large numbers of bacteria should be present in the blood, and this factor can only very rarely come into play in nature where the number of bacteria which enter the body at one time is seldom sufficiently great. Thus in the case of strangulated hernia, even where the circulation has been arrested for a considerable time, comparatively little harm is done, and unless actual gangrene of the bowel wall has occurred, bacteria are very seldom found in the fluid contained in the sac of the hernia, nor does suppurative peritonitis occur, for the number of pyogenic cocci in the intestinal canal is very small. In conclusion, I may mention an experiment by Cornil, who states that if a slight nephritis is set up, either by cantharides or in some other way, and if then pyogenic organisms are injected into the blood, a septic peritonitis occurs. This last experiment leads us to the consideration of a very important factor in the production of local depression of vitality, viz., inflammation.

Inflammation.—Inflammation is frequently looked on as a predisposing cause of these suppurative diseases, and it has been held that inflammation leads to the formation of a weak spot where bacteria can settle and develop, and that while inflammation can be set up by other causes than micro-organisms, the pyogenic cocci are very apt to become added to it, and then suppuration results. On the other hand, in old times when wounds were allowed to become septic, it was generally held that the patient was safer when the surface of the wound had become covered with granulations, than before granulation had taken place. We have also seen, in considering the anatomy of abscess, that as the granulation tissue increased in amount, so the penetration of the organisms into the body was rendered difficult, and they remained more and more limited to the interior of the abscess. In the case of erysipelas the cessation of the inflammation seems to stand in some relation to the accumulation of leucocytes in the part. In the case of tubercles also, which consist of a central mass of epithelioid cells and an outer wall of leucocytes, I believe that the external circle is purely an inflammatory circle, and is of great importance in limiting the spread of the tubercle bacilli. That, however, preliminary inflammation is not essential to

enable the pyogenic organisms to act, is shown by many facts, such as Garré's and Bockhardt's experiments on themselves, and by similar experiments performed by Grawitz with reference to acne contagiosa of horses where the organisms which are the cause of the disease produce it when merely rubbed into the skin.

To explain the facts of the case, I must shortly recall the chief points as regards inflammation. Inflammation which has gone on for some time may be divided into three stages. In the first stage we have the preliminary dilatation (or it may be in some rare cases, contraction) of the vessels, the increased flow of blood through the part, and, along with this, increased flow of lymph, soon followed by slowing of the circulation, and ultimately by inflammatory stasis with, at the same time, exudation of blood plasma and corpuscles. In the second stage, the irritation is continued, and the tissue originally attacked by the inflammation is removed and its place taken by granulation tissue. In the third stage, the irritation has ceased, and retrogressive changes occur, leading to the formation of a scar.

If we consider the state of the tissues in these three stages, we see that in the first stage, as was long ago pointed out by Sir Joseph Lister, the vital activity of the tissue is suspended, the functions of the part are, so to speak, paralyzed, in other words, the tissue has become an extremely weak tissue, and one unable to resist in any way the entrance of the parasites. In the second stage, this weak tissue has been removed, and its place has been taken by young, vigorous, healthy, granulation tissue, which has probably great power in repelling the attacks of the organisms. Lastly, in the third stage, this granulation tissue is getting older and becoming converted into less active tissue. The first stage of inflammation is partly defensive and partly reparative, and always occurs after every injury. The second stage may be looked on as a purely defensive stage, the irritant still continuing to act. In the third stage, the irritant has gone, and processes leading to permanent repair take place.

The relation of inflammation to infection may perhaps be best illustrated by regarding it as an instance of instinctive action. The first effect of the irritant is to damage the part, and the first result is dilatation of the blood-vessels and in-

creased flow of blood and lymph; the part in fact is flushed with blood as if an attempt were being made to wash away the irritating cause (Landerer). This is a process which is probably constantly occurring in our bodies with satisfactory results. If the irritant continues to act it is very soon found that these attempts are ineffectual, and the next instinctive method of protection is to get rid of the injured tissues and to supply their place by young, strong, healthy tissue, granulation tissue. Finally, when the irritating cause has been got rid of, the vigilance of the part is, so to speak, relaxed, and the tissues proceed to develop into a less active and less vigorous tissue, viz., fibrous tissue.

The uses of inflammation are not always apparent; the process is not guided by reason. The natural instinct of the tissues is, so to speak, to resent intrusion, and their mode of showing resentment is by inflammation. I some cases, as in erysipelas, this inflammation may be too late to be of any use in repelling the intruder, which has already passed on before the inflammatory changes have had time to occur. In other cases, the inflammation may be immoderate in amount and lead to extensive destructive changes—more extensive than those caused by the infective agent. Or again, the inflammation may weaken the tissues, and in the case of some organisms, the very attempt to resist their entrance may just open up the way for their action.

Clinically, the organisms enter during the first and last stages, more especially during the first, and not, as a rule, during the intermediate stage, unless, indeed, while growing outside the new tissue, on the surface of the wound, they can so injure it as to reduce it again to the position of a weak tissue—to the first stage in fact. This is very well shown in a series of experiments made by Huber on the localization of virus. Huber performed his experiments on rabbits, and set up inflammation in one ear by rubbing in croton oil, the other ear being left intact for purposes of control. The infective material employed was virulent anthrax bacilli, and these were introduced into the body as far as possible from the seat of inflammation, viz., at the root of the tail. According to the stage of inflammation which he desired to study, Huber applied the croton oil before or after the infection with anthrax bacilli. The result of these experiments was in the

first place that the bacilli were not found outside the vessels in the tissue of the inflamed part in any stage of the inflammation; and in the second place, that their presence inside the vessels was dependent on the stage of the local affection. Thus, in the first stage, where there was inflammatory œdema —this stage reaching its height in about seven and a half hours—there was a very marked increase in the number of the bacilli in the capillaries of the inflamed part, as compared with the number which were present in a similar part of the opposite ear. As the inflammation passed into the second stage, the number of bacilli in the capillaries of the inflamed part gradually diminished, till when this stage was at its height—after forty-eight hours—the bacilli had completely disappeared, although they were present in large numbers in the capillaries of the other ear. During the third stage, where the inflammation had subsided, and where new tissue was being formed, bacilli again appeared, and were found in considerable numbers in the newly-formed vessels. Ultimately, when the scar had been formed, there was no difference as regards the number of bacilli in the capillaries of the scar, and the number in the capillaries elsewhere.

It has been found as regards the pyogenic cocci, that if they are circulating in the blood, the induction of a severe inflammatory action does not lead to their deposit in the part, while if the inflammation is less severe, they can apparently pass out of the blood-vessels, and set up suppuration. Thus Rinne concludes from his experiments on suppuration that a violent inflammatory action did not produce a *locus minoris resistentiæ*, but that the slighter injury caused by the chemical products of the bacteria sufficiently weakened the part to enable the organisms to grow in it. Acute osteo-myelitis and local tubercular diseases frequently stand in some relation to injury, but they are not, as a rule, attributed to severe injuries, but usually to some slight blow or sprain. In a phthisical individual, fracture of a bone or some other severe injury, is not followed by the development of a local tuberculosis, whereas a slight sprain is very commonly mentioned as the exciting cause of such a process, the probability being that the severe injury sets up too great reaction to permit the organisms to act, while the slighter injury simply weakens the part.

Cold.—Another point which has been much discussed in relation to inflammation and suppuration is the effect of cold. It is generally assumed that cold is a frequent cause, or at least a very predisposing cause of inflammation, as, for example, in the production of pneumonia. That cold may play an important part as one of the factors in that disease is very probable, but it is needless for me to say that we are constantly subjected to violent changes of temperature, without the production of inflammatory disease, so that it seems as if when a result is obtained, some other factor comes into play.

Fraenkel, in his papers on pneumonia, points out that, as the organisms held by him to be the causal agents are frequently present in the respiratory tracts of healthy individuals, other causes, among which he mentions cold, must play an important part.

That cold can cause inflammatory affections where the conditions are suitable, is evident as regards the external surface of the body, from the production of chilblains, the tissue thus weakened being brought into a condition rendering it very liable to attack from organisms. As regards the effects of cold on the internal parts of the body, some very interesting observations have been made by Lassar. A number of rabbits were shaved or deprived of their hair in some way or other; these animals when kept at a suitable and equable temperature (about 20° C.) and well fed, remained in good health, but on being taken out of the warm room and plunged into ice-cold water, for from one to three minutes, then dried carefully, chafed and warmed again, they almost always in the course of one or two days showed albuminuria, increasing at a later period often to a great extent, and accompanied by the presence of hyaline cylinders in the urine; at the same time the rectal temperature was as much as 1.5° C. above the normal. These animals often recovered from the albuminuria, but were again similarly affected when again exposed to cold. On microscopical examination of the organs, they were seen to be in what Lassar terms a state of "interstitial inflammation;" the organs chiefly affected being the kidneys and liver, but also in some cases the lungs, muscular tissue of the heart, and the sheaths of the nerves. In the organs it was seen that there was no degeneration of the interstitial tissues, but the blood-vessels, especially in the lungs and liver, were often

enormously dilated, the arteries filled with thrombi, and large numbers of leucocytes were present in the tissues in the neighborhood of the veins. The effect of cold in these experiments seems, in fact, to be the production of what is probably a weak tissue, and one therefore liable to attack from organisms.

As to the relation of pyogenic organisms to animals acted on by cold, I only know of experiments by Grawitz on the relation of peritonitis to cold, but his experiments are not sufficiently satisfactory. He shaved the skin of the abdomen in young animals, covered it for from a half to one hour with warm compresses, and then suddenly removing these, allowed a draught of ice-cold air to play on the part for twenty to forty minutes. This caused no bad effect on the peritoneum, nor was any bad result produced on that membrane when organisms were simultaneously injected into the intestinal canal or into the blood; and in one experiment the cocci were injected directly into the abdominal cavity, also without setting up peritonitis. In the last experiment, however, the cocci were injected three-quarters of an hour before the commencement of the exposure to cold, and it is highly probable that, under the circumstances, they had died, or had been removed by the healthy peritoneum before the application of the cold; and this is the more likely to have been the case, seeing that the activity of the peritoneum was probably increased, as the result of the warm compresses applied to the skin over the abdomen.

Injury.—An important cause, predisposing to the occurrence of suppuration, is injury, which probably acts in two ways; in the first place, by setting up the early stages of inflammation; and in the second place, by leading to effusion of blood, and thus enabling any pyogenic cocci which may be circulating in the blood to pass out of the vessels, and find in the cellular tissue a suitable place for their development.

The effect of injury is well shown in experiments which have been made on the production of acute endocarditis. In order to induce this disease in animals, by injection of the pyogenic cocci into the blood, it has been found either that the number of cocci employed must be very large, or that they must be attached to gross particles, as has already been mentioned, or that some injury must be caused to the valves before their injection. Wyssokowitsch and others have per-

formed experiments of this kind, and have found that by introducing a rod into the jugular vein, they were able to cause laceration of the valves, and that then, on subsequent injection of staphylococci into the blood, ulcerative endocarditis occurred. The effect of the injury in this instance is no doubt chiefly to lead to loss of resisting power in the endothelial and connective-tissue cells, as the result of the early stage of inflammation induced by it.

The relation of injury to certain inflammatory diseases in man is generally accepted, and I need only instance the case of acute osteo-myelitis which is frequently attributed to an injury. In experiments on animals, with regard to the production of acute osteo-myelitis, it is, as a rule, necessary not only to inject the pyogenic organisms into the blood, but also to cause some injury to the bone. If this is done, especially where large numbers of cocci are introduced into the circulation, the animals generally die in from twelve to fourteen days, much emaciated, and showing pus at the seat of fracture, pus in the medulla, and necrosis of bone. With regard to man there are several cases on record in which the relation of injury to this disease is very strikingly shown; and the fact that the disease occurs much more often in males than females, and especially in young males, is usually attributed to the fact that injuries are sustained more frequently by boys than girls. At the same time, the number of cases of acute osteo-myelitis in man, in which the direct relation to an injury can be satisfactorily traced, is in reality comparatively small; and that injury, though it plays a part in some instances, is not an essential condition for the production of the disease, is shown by its occurrence after acute fevers, and also by the fact that it is limited, as a rule, to certain favorite seats. When, however, the disease affects bones or parts of bones which are not usually attacked, a history of injury or exposure to cold can generally be obtained to explain its occurrence in these abnormal situations. In the case of wounds also, we must not forget that the injury done to the surface of a wound during an operation by the knife and the manipulations, sets up the early stage of inflammation, and that thus the surface of a wound is, for a few hours at any rate, a weak surface, and one unable to resist attacks from organisms.

That one great explanation of the value of injury in aiding

the occurrence of suppurative diseases is the extravasation of blood from the vessels is shown in a very striking manner by experiments on symptomatic anthrax, a disease to which I shall have to allude in detail presently. I may say here that this disease is caused by bacilli, but is not set up if the bacilli are introduced into the circulating blood; in order to produce it the bacilli must act in the cellular tissue. After injection of the organisms into the blood, the animals remain well, and the bacilli very soon disappear; if, however, shortly after the injection of the bacilli into the blood, a bruise is produced in some part of the body, the bacilli pass out of the vessels into the cellular tissue along with the blood, grow there, and soon cause the formation of the characteristic tumors, the spread of the disease, and its fatal termination. In man it is sometimes seen that bruises in weakly individuals are followed by suppuration, and I have already published the case of a drunkard who had albuminuria, and was in a very low state of health, and who, whenever he received a bruise, developed an abscess at that part. In his depressed state, the pyogenic cocci were probably able to live in his blood, and the injuries, by setting up the early stage of inflammation, and thus further weakening the tissues, and also by leading to the effusion of blood containing the organisms, gave rise to the formation of abscesses.

Irritating Chemical Substances.— Another important cause of depression of vitality is the presence of irritating chemical substances. The mode of action of these chemical substances is probably that, when concentrated, they destroy the vitality of the tissue by their caustic effect, and when more dilute, they set up the early stage of inflammation, which also occurs in the former case in the vicinity of the dead part. The effect of these substances in procuring a weak spot at which the organisms can develop, is no doubt the explanation of Kocher's results with regard to acute osteo-myelitis in dogs. He found that if digestive disturbances were induced by the introduction of large quantities of septic material into the intestinal canal, and if, at the same time, a bone was injured by the injection of ammonia or other irritating chemical substances into it, acute osteo-myelitis occurred at the seat of injury, while the injection of the chemical substances alone only produced temporary reaction. These

experiments, however, were only few in number, and are not completely satisfactory, because it is possible that the organisms spread in along the needle track, and did not reach the part from the blood. It has also been found that if irritating chemical substances are injected subcutaneously into rabbits, and if, at the same time, large numbers of pyogenic cocci are injected into the veins, suppuration frequently occurs at the seat of injection, the suppuration going hand in hand with the development of the pyogenic organisms which have reached the part from the blood (Biondi).

Many of the former experiments on the production of suppuration by means of irritating chemical substances, which frequently resulted in growth of micro-organisms in the part, and, as a consequence, the occurrence of suppuration, show how the presence of irritating chemical substances placed the parts in a condition which diminished their resisting power against the action of micro-organisms. Grawitz and de Bary found that if croton oil was injected into rabbits subcutaneously, it caused inflammation, and sometimes, in their opinion, suppuration; if, however, the pyogenic organisms were also present, suppuration always occurred, although these cocci alone in small numbers are unable to produce suppuration in the normal subcutaneous tissue of dogs or rabbits.

If I may venture to apply these facts to the treatment of wounds, it seems to me that if the views which I have attempted to develop as to the importance of a granulation wall as a barrier against micro-organisms are correct, it is questionable whether, in the case of wounds which have become septic, it is well to wash them out with irritating antiseptics, as is so often done at present. That it is well to remove the decomposing discharge both by free drainage and also by washing out the wound in some cases is of course evident, but where strong irritating antiseptics are employed, unless they are able to kill all the micro-organisms present in the wound, and thus render it aseptic, the result of their injection might be, I think, that they will injure the granulation wall, and thus produce a weak spot in which the pyogenic cocci present in the wound can develop, and through which they may be enabled to enter the body. Thus it has been found that in cases of tubercular disease of bones and joints, accompanied by suppuration, general tuberculosis, more espe-

cially tubercular meningitis, occurs by far most frequently where sinuses have become septic, and more especially where, in addition, these septic sinuses have been much irritated by futile antiseptic injections. Hence it seems to me that, except in cases where there is reasonable ground for believing that the injection of these antiseptics into septic wounds will completely eradicate the organisms, it is better to avoid the use of irritating antiseptics such as carbolic acid, and if it is thought well to wash away the discharge, to employ some fluid which will not injure the granulation wall.

Except in the case of wounds, the chemical substances which aid in enabling the bacteria to gain a foothold, are the products of the organisms themselves. That various bacterial products are highly poisonous is now well known, and in the case of putrefactive and pyogenic organisms these products are able not only to cause local trouble, but also to set up fever, to depress the vitality of the patient, or it may be even to cause death. With regard to these general effects of the chemical products of bacteria, it is unnecessary for me to enter into further detail, for the fact is now so well known that in most books on surgery we find, in addition to septicæmia and pyæmia, a third group of general septic diseases, due to the action of these products, described under the title of septic intoxication or, as Dr. Matthews Duncan has termed it, sapræmia. I may, therefore, at once pass on to the local effects of the products of bacteria and their action in enabling the organisms to live and multiply in the part.

I need only mention in this respect Panum's well-known researches, in which he found that although he destroyed the bacteria present in a putrefying liquid, he still had a fluid which, in sufficient quantities, was intensely poisonous and rapidly caused the death of the animal. The same was the case in Koch's experiments, in which he found that the injection of a large quantity of putrefying fluid into mice frequently occasioned the rapid death of the animal, while if a minute amount only was introduced, the animals either survived or fell victims to some infective disease, the result of the development of bacteria. A number of these poisonous bases, the products of putrefactive fermentation, have now been isolated by Brieger.

Products of the Bacteria themselves.—In some experi-

ments which I performed recently with an organism described by Hauser under the name of proteus vulgaris—an organism not uncommonly present in putrefying materials—I diluted the growth in gelatin with a certain amount of water before injection. In some cases, however, I used for dilution, instead of water, boiled meat infusion, in which the same organisms had been growing, that is to say, a fluid containing the products of the growth of these bacteria, and I found, for example, that while one-fortieth c.cm. of the mixture prepared by the addition of water never killed the animals experimented on, where the dilution was made to the same degree with the boiled meat infusion, the animals died from the same dose after about forty-eight hours. In the second case, a larger quantity of the products of the bacteria—these products being very poisonous—was introduced than in the first case, and to this we must ascribe the difference in the result. In experiments on guinea-pigs with the cholera bacillus, Hueppe has found that infection occurs more certainly and with less material, if there has been preliminary action on the intestine of the poisonous products of the cholera bacilli, or even of the ptomaines of other bacteria; and Flügge and Wyssokowitsch have shown that bacteria which are not usually pathogenic in the animals employed for the experiments, can penetrate into tissues previously weakened by bacterial poisons.

Among the products of the putrefactive fermentation there are two substances which have been found to be highly irritating, viz., cadaverine and putrescine; and I have previously referred to the experiments made by Grawitz and Scheuerlen, which show that, as the result of the injection of these substances, inflammation and suppuration may occur according to the strength and quantity of the solution employed. Grawitz found further that suppuration certainly occurs, if, at the same time that a comparatively dilute solution of cadaverine is injected, pyogenic cocci are introduced. The chemical products of the pyogenic cocci are also, according to Grawitz, irritating to the subcutaneous tissues of dogs and rabbits, when introduced in sufficient quantity and concentration. Thus he found that if sterilized cultivation of pyogenic cocci were injected in large quantities into dogs—for example, four c.cm. of a sterilized cultivation of staphylococcus pyogenes

aureus—suppuration occurred, the pus being free from organisms.

Products of the Pyogenic Organisms.—As regards the products of these pyogenic cocci, Brieger, who is the great authority on this subject, states that he has been unable as yet to obtain any toxine from the cultivations of these organisms. Cultivations of staphylococcus pyogenes aureus on moist beef or veal yield large quantities of ammonia, as does also the staphylococcus pyogenes albus; the latter produces, in addition, considerable quantities of trimethylamin. Streptococcus pyogenes likewise produces ammonia and trimethylamin. That the ammonia must irritate the tissues is of course evident, and it is probable that in the nascent state it is still more irritating; while as regards trimethylamin, though it is not an alkaloid, it is, in Brieger's opinion, probably a descendant of, or very closely allied to, the ptomaines, and when present in considerable quantities in the body is very hurtful to it. These organisms also produce a peptonizing ferment, and can thus peptonize and dissolve coagulated albumen; and this property is, as we have seen, of great importance in suppuration. When sown in milk they rapidly set up a pure lactic fermentation, leading to the production of large quantities of lactic acid, as the result of which the milk coagulates if kept for some days at the temperature of the human body. This production of lactic acid is an important fact, as it probably also takes place sometimes in wounds, causing acidity of the discharge, and in abscesses causing the well-known watery pus. Whether ptomaines will yet be found in the case of the pyogenic cocci we cannot say, but the occurrence of fever in suppurative diseases may possibly, as Baumgarten suggests, be explained simply by the increased tissue change as the result of their growth, the products thus formed requiring increased combustion, and perhaps also stimulating the thermic centres, and hence causing elevation of temperature; and in support of this view, Baumgarten refers to the fever which occurs in trichinosis, where there is no idea of any action of ptomaines.

Leber ("Fortschritte d. Medicin," 1888, No. 12) states that he has isolated a crystalline substance, which he calls phlogosine, from cultivations of staphylococcus pyogenes aureus, which causes suppuration when injected into animals.

Seat of Inoculation and Anatomical Arrangement of the Part.

Much depends also, as regards the effect of these organisms, on the seat of inoculation and the anatomical arrangement of the part. These conditions are of importance in two ways: in the first place, certain organisms will not grow everywhere in the body, they will only grow in certain tissues; and, in the second place, in some cases, especially in the case of the pyogenic organisms, the character of the resulting disease varies chiefly according to the anatomical arrangement of the part in which the organisms are growing.

Some organisms, such as the higher fungi, seem only to be able to act if they are present within the capillary blood-vessels or large serous sacs; the bacillus of malignant œdema acts only in the cellular tissue; the micrococcus of erysipelas possibly only in the. lymphatic vessels. As this is an important matter, I may refer, in some detail, to a few examples which show the great influence which these conditions exert on the development and the character of the resulting disease. In some experiments which I performed with Hauser's proteus vulgaris, I met at first with some very interesting difficulties. I injected the cultivations into the backs of rabbits, and I found that the results obtained varied in a manner very difficult to understand. After considerable investigation, I found that the differences depended on the seat of inoculation; that if the material was injected superficially to the muscles, a different result might be obtained to that which followed injection into the substance of the muscles. Thus quantities of a cultivation which, introduced into the subcutaneous tissue, would only have caused a large abscess, were followed, when injected into the muscles, by the death of the animal; and further, a small dose which would have been without noticeable effect on the subcutaneous tissue, was sufficient to produce an abscess when injected into the muscles. What the explanation of this difference is I am unable to say: it is possible, however, that some chemical substance in the muscle is readily broken up, and readily gives rise to poisonous compounds, and that this substance does not exist, or is present in less amount, in the subcutaneous tissue. Similar differences, according as injections were made into the subcutaneous

tissue or into the muscles, were noticed in the case of several other bacteria.

Fehleisen ("Deutsch. Archiv f. klin. Chirurg.," Bd. 36, Hft. 4) says, that while a large quantity of staphylococcus pyogenes aureus is necessary to cause death when injected into the peritoneum, a much smaller quantity (about one-twelfth of the amount) causes suppuration in and around joints when injected into them. He also says that pus varies in virulence according to its origin, different tissues probably producing different ptomaines.

Perhaps the best example of the great influence exerted by the seat of inoculation and anatomical arrangement of the part is furnished by the disease known in this country as "Black Leg," in Germany as "Rauschbrand," and in France as "Symptomatic Anthrax." This disease has been investigated by a number of observers, chiefly by three French writers who have worked together, viz., MM. Arloing, Cornevin, and Thomas. The disease chiefly affects cattle and sheep, more especially cattle, and is characterized by the rapid appearance of irregularly limited swellings of the skin and muscular tissues, these swellings being at first very painful and tense, but rapidly becoming painless and crepitating. The disease is accompanied by fever, which is often very high, and it is almost always fatal, usually after a duration of from thirty-six to forty hours. The cause of the disease has been demonstrated to be a bacillus which grows without free oxygen, and thus belongs to Pasteur's class of anaerobes. These bacilli are remarkable in various ways, more especially in the conditions under which they exert their pathogenic action. In order to cause the death of the animal, the organisms must be introduced either into the subcutaneous tissue or into the muscles: if they are injected into the veins or into the bronchi, they do not cause the death of the animal, but apparently after a time die out, leaving the animal, however, protected against the disease. And I have already mentioned that if, after the virus has been injected into the veins, a bruise is caused in some part of the body, the organisms reach that spot from the blood, grow there, and set up the disease. If inoculations are made quite at the tip of the tail in cattle, the result is only a moderate amount of reaction, even when large quantities of the material are introduced; the more proximal on the tail is the seat of inocula-

tion, the more readily is a result obtained. The explanation of this fact is apparently partly the dense nature of the connective tissue at the tip of the tail, and partly also the low temperature of the part. That the density of the tissue in the tails of cattle interferes with the spread of the infection is evident, because sheep, at the tips of whose tails the cellular tissue is loose, react markedly on inoculation in that part. As regards the temperature of the part, it has been found that if, after inoculation, the tail is wrapped in bad conductors of heat, the local temperature can be so raised that considerable reaction occurs, and *vice versâ* in the case of sheep; if, after inoculation, the part is kept cool by the application of ice-bags, the violence of the local reaction is much reduced.

As regards the pyogenic organisms, most of them act in the cellular tissue to which they gain access, as a rule, after the destruction of the epithelium. The gonococcus is, so far as we know, the only pyogenic organism in man which is able to penetrate uninjured epithelium; and with regard to the gonococcus, it is very striking that it only attacks certain mucous membranes, and apparently cannot develop in any other tissue of the body unless, perhaps, in the joints in which, according to Kammerer, it is present in some cases of gonorrhœal rheumatism. (It must be said, however, that other investigators have failed to confirm this observation.) Bumm states that pure gonorrhœal pus may be injected into the subcutaneous cellular tissue without causing any reaction, and that if, after twenty-four hours, an incision is made into the part, and some of the pus which was injected is removed, it will be found that the pus cells are in good condition, but that the cocci have disappeared. This is a fact of great interest, as showing that pus, apart from the micro-organism which it contains, does not exert a pyogenic action. Also, as I have previously said, when suppurative bubo occurs after gonorrhœa, the staphylococcus pyogenes aureus or albus is present in the pus from the gland and not the gonococcus, suppurative bubo being therefore the result of a mixed infection, and not a necessary complication of gonorrhœa. The same is the fact in the case of abscesses in connection with the urethra in cases of gonorrhœa. Kitt has found that in the case of the coccus of mastitis in cows, the organisms only exert their pathogenic action when they are present in the

ducts or acini of the mamma; if injected directly into the tissue of the mamma, they cause no suppuration.

Anatomical Arrangement of the Part.—The anatomical arrangement of the part is probably a very important factor in the production of acute osteo-myelitis. This disease is, as we have seen, due to the action of pyogenic cocci, and it not infrequently stands apparently in some relation to an injury. But the injury and the presence of the cocci do not explain the whole of the etiology of the disease, more especially they do not explain why it is that the disease is almost entirely limited to certain bones and to certain parts of bones. Not that most of the bones in the body may not, under certain circumstances, become the seat of this affection, but as a rule the disease has certain very favorite seats, such as the femur, especially its lower end, the upper and lower ends of the tibia, the upper end of the humerus and the radius.

It is very seldom, indeed, that the ulna, and still more seldom that the fibula is attacked.

Now, these are the bones which grow most rapidly, and in them the disease commences during the period of growth, and most usually in the neighborhood of the epiphyseal line where the growth is of course most active. Thus the fact that the bones are growing, helps apparently to determine the seat of the disease, possibly because there is a large amount of young indefinite tissue at these parts, possibly also because there are plenty of blood-vessels, and also, perhaps, because the circulation in the ends of the bone is apparently less rapid than elsewhere (Neumann). It is interesting also to note, as showing probably the influence of similar conditions, that when this disease attacks infants, it is usually limited to the neighborhood of the epiphyseal line, giving rise to acute epiphysitis. At the same time, the anatomical peculiarities will not suffice to explain all the facts, because in growing animals belonging to species not insensitive to this poison, the disease is not produced by injection into the circulation unless some other determining cause, such as injury, comes into play; and because also the disease not infrequently occurs after acute fevers, such as typhoid fever. As regards the anatomical arrangement of the part in its relation to acute osteo-myelitis, all that we can say, therefore, is that there is some peculiarity in growing bones not necessarily limited to the growth at the

epiphysis, which has an important influence on the production of the disease.

The only other possible view in the cases is where no injury can be made out, would be that the disease is a specific one, and that the virus can only grow in these situations. This view is, however, untenable, as shown both by clinical facts, and also by the fact that the organisms of acute osteo-myelitis are the same as those which are present in ordinary suppuration.

Another example of the manner in which the occurrence of disease may be influenced by the anatomical arrangement of the part is the frequency with which pyæmia occurs after acute osteo-myelitis. This is evidently due, in part at any rate, to the high pressure which the pus is subjected to in the medulla of the bone, as shown by the manner in which the fatty matter oozes out of the bone when it is trephined, and also by the occurrence of fatty embolism in the lungs. Just as fatty emboli may pass into the circulation, so may emboli, consisting of groups of cocci, or of pus containing cocci, occur.

In the case of certain organs also, it is possible that their peculiar selective affinity for certain viruses is, to a considerable extent, due to the anatomical arrangement of the part. The great tendency of infective materials to become located in the kidneys is very striking. I have already referred to experiments where deposits of micrococci were found only in the kidneys, and this is also the case with staphylococcus pyogenes aureus when injected in moderate quantities into the veins of rabbits. The accumulation of organisms in that organ is also seen in the case of a number of other bacteria, and even of the higher fungi, such as the pathogenic forms of mucor and aspergillus. It seems to me possible that in the case of the kidney, its excretory function may have something to do with the tendency of organisms to accumulate in that organ. Grawitz, however, thinks that this selective affinity is due to differences in the energy with which different organs assimilate nutriment, and he has constructed a scale showing the vital energy of the various organs, and at the bottom of this scale he places the kidney. That this is not the explanation is evident from the fact that in many cases other organs are more frequently involved than the kidneys. For example, in the case of the pathogenic aspergilli in rabbits, the membran-

ous labyrinth is apparently a favorite seat of these fungi, and this is the explanation of the rotatory movements which are so characteristic of the affection produced by these fungi in rabbits. Another example of peculiar selective affinity is seen if we compare the course of acute tuberculosis in man and in rabbits. In man, acute general tuberculosis seldom runs its course without the occurrence of tubercular meningitis: while in rabbits, I have never met with tubercular meningitis in the course of a large number of inoculation experiments.

I have also said that as the result of differences in the seat of inoculation and the anatomical arrangement of the part, there may be differences in the character of the disease produced. Virchow has long ago pointed out that the cause of a disease does not by any means determine the product of the disease, for that depends chiefly on the internal predisposition; thus the same agent acting on the cellular tissue may cause thickening of it, and acting on the periosteum, may lead to new formation of bone. This is probably a great part of the explanation of the different types of disease produced by these pyogenic organisms, according as they act in the skin or in the connective tissue. I have previously mentioned the result of Bockhardt's investigations on impetigo and boil, from which it is evident that the character of the inflammation depends greatly on the point of entrance and the seat of development of the organisms, and Garré also comes to the same conclusion. It seems that in the case of multiple abscesses of the skin in infants, the cocci also spread into the hair follicles and sebaceous and sweat glands, and growing there, set up inflammation and abscess, the process being similar to that which occurs in the formation of boils in adults, but being clinically distinguished from that by the tendency to form true abscesses, and by the abscence of necrosis. Escherich believes that these differences depend on differences in the degree of tension of the skin in adults and infants, more especially in atrophic infants, in which these abscesses are especially apt to occur. It is possible, however, that, as Baumgarten points out, the greater softness and irritability of the tissues of the child as compared with those of the adult, play an important part.

The different course which is run by acute osteo-myelitis when it occurs spontaneously, and when it follows operations

on bones, is also probably due, in the main, to the seat of inoculation. In the latter case, we never see the scattered patches of necrosis which so frequently occur in the former, and this may be explained by the fact that, in the latter, the infective agents spread continuously in the tissue from the point of inoculation, whereas in the former they are carried by the blood and may be deposited at various parts, thus giving rise to various foci of disease.

CHAPTER IV.

Suppurative Peritonitis.—Another example of the influence of the seat of inoculation and the anatomical arrangement of the part is the difference in the behavior of the peritoneum as compared with the cellular tissue in regard to the pyogenic organisms. In former times the peritoneal cavity was looked on as one especially liable to inflame, and it was thought to be one of the chief triumphs of antiseptic surgery that operations could be performed on the peritoneum without bad result. The experience of a number of surgeons, however, has now shown that it is not absolutely necessary for success in operations on the peritoneal cavity that all bacteria should be excluded; in fact, this seems to be much less necessary than where operations are performed on other serous cavities, such as joints, or on the subcutaneous or muscular tissues.

The explanation of this surprising result is found in the nature of the lining wall of the cavity, and in the conditions under which pyogenic organisms find themselves there. The peritoneum has marvellous powers of absorbing fluids, and thus effusions into it are very rapidly removed, and in this way micro-organisms are deprived of the necessary nutrient material, while they are also in all probability absorbed along with the fluid, and destroyed in the blood or excreted. Wegner, who performed a number of experiments on this subject some years ago, has shown in a very striking manner the great absorptive power of the peritoneum. I may mention one of his experiments: 200 c.cm. of warm serum were injected in the peritoneal cavity of a rabbit, an hour later the animal was bled to death, and the amount of fluid then present in the peritoneal cavity was only 66 c.cm., no less than 134 c.cm. having been absorbed in one hour. Apparently the rapidity of absorption of fluid depends, in the first place, to a great extent on the tension under which the fluid is, fluid un-

der low tension, as when the walls of the abdomen are lax, or the fluid itself is small in amount, being absorbed comparatively slowly; and in the second place on the nature of the fluid, fluid of lower specific gravity than blood serum, leading in the first instance to transudation from the blood. If we contrast with this the condition of a wound in the cellular or muscular tissues in respect of its absorptive power, we find that we have not here an actively absorbing surface; in fact, the whole surface is for a few hours in the early stage of inflammation, as the result of the injury done by the knife, and is not only not an absorbing surface, but is not even a healthy surface.

Wegner has also shown that a great variety of fluids free from bacteria, such as water, bile, urine, blood, etc., may be injected into the peritoneal cavity of rabbits without causing any bad results, and even large quantities of unfiltered air may be similarly introduced without setting up peritonitis, the air being soon absorbed, though by no means so rapidly as fluids. If putrescible fluids are injected into the peritoneal cavity at the same time that air is introduced, they rapidly undergo decomposition, but this is only the case if the quantity of fluid is too great to be quickly absorbed. Thus 15 c.cm. of putrescible fluid injected into the peritoneal cavity of a rabbit will usually be absorbed before decomposition has had time to occur, but if as much as 50 c.cm. are employed, then only a part is taken up during the first hour, and the rest furnishes a substratum for the growth of the organisms present in the injected air, and these organisms develop with extraordinary rapidity, and may cause the death of the animal from septic intoxication.

In none of Wegner's experiments with the injection of putrefying or putrescible fluids and air, did peritonitis occur, and Grawitz, who has since investigated the matter, has directed special attention to the conditions under which peritonitis is produced. Apparently the explanation why Wegner did not obtain peritonitis, but only septic intoxication, is that pyogenic organisms are not frequently present in the air, and were therefore not injected along with it, and also that they only act under certain special conditions.

As the result of Grawitz's experiments, the following seem to be the facts of the case. In the first place, saprophytic

bacteria are absorbed or destroyed by the peritoneum in relatively enormous numbers; where, however, the peritoneum is abnormal, or where the bacteria are able to set up putrefaction, the symptoms of septic intoxication as described by Wegner result, but these symptoms are unaccompanied by suppurative peritonitis. In the second place, pyogenic organisms, when injected in small numbers into the normal peritoneal cavity, and when suspended in such an amount of indifferent fluid as can be readily absorbed, cause no peritonitis; but, on the other hand, peritonitis occurs as the result of the injection of these organisms if the peritoneum is abnormal, or, if with a normal peritoneum, large numbers of pyogenic cocci are introduced, or if the cocci are suspended in too large an amount of fluid to be quickly absorbed. The necessary abnormal conditions of the peritoneum may be set up, if at the same time that the pyogenic organisms are introduced, substances act which weaken or kill the tissue of the peritoneum; and thus provide a suitable soil for the penetration of the cocci; and above all, if there is a wound of the peritoneal wall in which the infective organisms can develop.

The factors, which are required to produce suppurative peritonitis are—the presence of the pyogenic cocci, usually the streptococcus pyogenes, along with too large an amount of fluid to be rapidly absorbed, or along with disease of the peritoneum, or themselves in too large numbers, or acting in too great concentration. In other words, to develop suppurative peritonitis, the cocci must either be introduced in such numbers along with their products, that a part of the peritoneum is at once injured, and thus ceases to exercise its normal functions; or they must be introduced into an unhealthy peritoneum, or they must be able to grow in the peritoneal cavity, either because fluid is present in too large a quantity to be quickly absorbed, or because the absorptive power of the peritoneum has been diminished, or because some material, such as a piece of blood clot, or a piece of injured or dead tissue, is present, in which they can develop.

Suppurative peritonitis occurs with the greatest certainty where there is a wound of the abdominal wall, in which the infective agents can develop, and which forms a centre from which organisms are constantly given off into the cavity, and from which the organisms can spread in the tissue of the peri-

toneum. It is still more certain to occur if the wound is an unhealthy one. This is well exemplified by the difference in the result of operations for rupture of healthy intestine, and for perforation in typhoid fever for example. In the rupture of healthy bowel, if the extravasated contents are thoroughly removed from the peritoneal cavity, and the wound stitched early, recovery frequently occurs. In perforation, after ulceration of the bowel, the wall of the hole is unhealthy, and forms a nidus in which the organisms grow, and the only chance of success in such a case is resection of the portion of bowel involved. The danger of peritonitis after perforation depends (1), on the nature of the materials extravasted into the peritoneal cavity; (2), on their quantity; and (3), on the previous existence of ulceration of the coats of the ruptured viscus.

It is evident, therefore, that when surgeons draw conclusions to the effect that aseptic treatment is unnecessary in surgical practice, because they obtain good results in operations on the peritoneum when they take care to introduce as few of these organisms as possible—in many cases, probably, none at all are introduced—to introduce them in as dilute a state as possible, to remove all the fluid and other materials, such as blood clot, in which they can grow, and to avoid injury to the peritoneum, as far as they can, they make an assumption which is not at all in accord with other clinical and experimental observations. The points which I have mentioned amply explain the results, and bring them into unison with those of experiments and of clinical experience with regard to other tissues of the body.

It is an equally erroneous assumption that because good results may be got in peritoneal surgery in this way, it is therefore the right method of treatment to adopt. The good results thus obtained depend, to a great extent, on chance, and are only got with a great deal of trouble. Surely, seeing that by destroying the organisms before they enter the body the element of chance is abolished without any harm to the patient, and with less trouble to the operator, it must be very wrong to subject the patient to an unnecessary, even though possibly a small risk. And, besides, it is only a surgeon of large experience who can get good results in these cases without aseptic treatment, while the employment of that treat-

ment puts it in the power of any reasonably qualified surgeon to obtain equally good and even better results.

Indefinite Conditions on the Part of the Body.

We have also to consider conditions of a more indefinite character on the part of the body. Thus:

Age, as we have seen, is an important factor in the production of acute osteo-myelitis. This is a disease of youth, and occurs most frequently between the ages of seven and twenty, and I have mentioned the different situations which are attacked in infants and in youths. Other diseases also vary in frequency at different ages; thus spontaneous erysipelas is apparently most frequent in persons between thirty-five and forty-five years of age, and next most frequent between forty-five and fifty-five. Diphtheria most commonly occurs below five years of age, and steadily decreases in frequency as the patients grow older.

Sex.—As regards sex also, we find in some of these diseases a marked difference in the frequency of occurrence in the two sexes; thus spontaneous erysipelas is apparently much more frequent in women than in men. Eschbaum found in 181 cases, that 122 of those attacked were females, and only 59 were males. Osteo-myelitis is, as we have seen, most common in males.

State of the Digestive Organs.—It is possible that the state of the digestive organs may have an important influence on the occurrence of these suppurative diseases, as shown by Kocher's experiments and views on the production of acute osteo-myelitis. Kocher came to the conclusion, in the case of dogs, that after injury to bone this disease could be induced by feeding the animals with large quantities of putrid materials; and he thinks that in many cases of acute osteo-myelitis, the starting-point is a disturbance of the digestive organs, permitting excessive multiplication of bacteria in the intestinal canal, and their entrance into the blood. In fact, Kocher holds that an individual in whose intestinal canal fermentative changes of an intense character are going on, is practically in the incubation stage of acute suppurative inflammation, which will then develop if an injury or some other local depressing cause comes into play. In this way Kocher ex-

plains the occurrence of acute osteo-myelitis after typhoid fever, and he relates a case observed by Kappeler as bearing on this view, in which a girl, shortly after recovery from an attack of epidemic cholerine, knelt for a long time in church, and was immediately afterward attacked with acute osteo-myelitis of the tibia. Kraske, however, who has paid great attention to this matter in post-mortem examinations of cases of acute osteo-myelitis, and has carefully examined the wall of the intestine and the mesenteric glands, both microscopically and by cultivation, states that he has never been able to obtain any evidence that the infective material had entered the body by these channels. Whether Kocher's view is correct or not, the possibility that during the progress of some wound or inflammatory disease, if the digestive organs are very much out of order, organisms may multiply to a great extent in the intestinal canal, and may enter the blood, and thus reach the seat of the local disease or injury, is worth bearing in mind.

Diet.—It is possible also that the nature of the diet may affect the occurrence of these diseases. It has been observed, for instance, in the case of symptomatic anthrax, that calves are more or less immune against this disease so long as they are fed on milk; but that after this period has passed, and when their diet becomes exclusively vegetable, they lose their immunity. Arloing, Cornevin, and Thomas explain this by supposing that the milk diet induces a particular constitution of the body, which is unfavorable to the development of this disease; but on the other hand, this may be a mere coincidence, and the cause may be some peculiarity in the youthful connective tissue.

State of the Blood—Diabetes.—The state of the blood is also of importance; for example, the frequency of carbuncle and furuncle, and of ulcerative and suppurative affections, and their stubborn course in cases of diabetes is well known. It is very probable that part of the explanation of this fact is the presence of the sugar or its chemical progenitors in the juices of the part, leading to the formation of a better pabulum for the development of the micro-organisms; though, no doubt, much depends on what we must more vaguely term the general depression of vitality of the tissues, caused by the disease.

Since the above was written, Bujwid ("Centralblatt für

Bakteriologie, etc.," Vol. IV., p. 577) has investigated this point, and has found that the second hypothesis is the correct one. He first ascertained that the pyogenic staphylococci did not grow so well in nutrient media, containing 5 per cent of grape sugar, as in the ordinary material. He then ascertained the number of these cocci required to do harm when injected subcutaneously, and he estimates them at more than one billion in rabbits. If, however, they were mixed with a fluid containing 25 per cent of grape sugar, one billion caused a large abscess; while, without the sugar, the same quantity produced no effect. Again, if about 500,000 cocci were injected in a fluid containing 12 per cent of grape sugar, they did no harm; but if in another animal the same quantity was injected, and a 12-per-cent solution of grape sugar was also injected daily at the same spot, an abscess formed. The daily injection of the grape sugar alone did not cause abscess, nor did abscess occur if three days elapsed before the second injection, *i.e.*, if time were given for the staphylococci to be destroyed. The injection of ten syringefuls of a 10-per-cent solution of grape sugar into the veins, and of one billion cocci subcutaneously at the same time, led to gangrene of the skin at the seat of the injection. These experiments were repeated and confirmed by Karlinski, and they show that the presence of grape sugar in the tissues so depresses their vitality, that the pyogenic cocci can act in much smaller numbers and more vigorously than would otherwise be the case.

Dilution of the blood also apparently interferes, to some extent, though only slightly, with the rapidity with which bacteria are killed in it. Thus Von Fodor found that if at the same time that non-pathogenic bacteria were injected, a quantity of water was introduced into the blood, the bacteria did not disappear so quickly as in undiluted blood. Pettenkofer, in fact, has come to the conclusion that everything which increases the amount of water in the body, increases the predisposition of the individual to infective diseases.

Albuminuria.—There is no doubt, also, that other chronic affections, such as albuminuria, predispose to septic diseases.

Acute diseases, such as acute fevers, also predispose to these affections, as in the case of the occurrence of acute osteomyelitis after acute fevers, of pneumonia after typhoid fever, etc.; probably in part, because, as in the case of scarlet fever,

the pyogenic organisms are able to enter and live in the blood.

Tension apparently has a considerable influence in causing inflammation, and in predisposing to suppuration. The spread of an abscess after it has once completely formed, is no doubt largely due to the tension of its contents, for the microscopical examination of the wall shows that the increase is not due, after a time, to the spread of the organisms in the tissues; and also if an abscess is opened aseptically and well drained, the secretion of pus ceases. The same is seen in the case of wounds, where, if micro-organisms are present, the occurrence of tension from accumulation of discharge, is apt to be followed by suppuration, and where, on relief of the tension, the suppuration ceases.

I have more than once observed in abscesses which had been opened aseptically, that when the drainage tube had become blocked, or had slipped out, the retained fluid was clear serum and not pus, if it was let out in the course of twenty-four or forty-eight hours.

Lessening of Predisposition.—In some cases, however, the predisposition is apparently lessened as the result of the action of various indeterminate causes; and apparently, also, this lessening of the predisposition may be due to a previous attack of the same disease, though, as regards the organisms under consideration, erysipelas seems to be the only case where a temporary and partial protection is attained.

Conditions on the Part of the Bacteria.

We now come to the consideration of the conditions which more especially affect the bacteria, and which are not perhaps of less importance than those to which we have been alluding; these are chiefly the species, the dose and concentration of the organisms, the virulence, and the concurrent growth with other bacteria.

Influence of Species.

As regards the species, while, as we have said before, the nature of a disease does not by any means altogether depend on its cause, it does so to a very large extent; and all writers are now agreed as to differences in the pathogenic action of the pyogenic streptococci and staphylococci. These differ-

ences have been previously referred to, and it has been seen that the streptococci are generally associated with erysipelatoid processes, while the staphylococci tend to cause more circumscribed suppurations. The streptococcus is by far the most dangerous organism, and apparently has the property of creeping in the living tissue, spreading in it for a time without being noticed, and then setting up violent reaction. Fraenkel has found streptococcus pyogenes in a great variety of puerperal diseases, especially in the so-called lymphangoitic forms. It gains entrance to the cellular tissue of the pelvis from ulcers in the vagina, spreads in the pelvic cellular tissue, reaches the ligamenta lata and the peritoneum, and spreading along the lymphatic channels, ultimately attacks the diaphragm and pleura; finally it reaches the blood, and causes septicæmia, pyæmia, suppuration in joints, etc. As regards the other pyogenic cocci, I have already referred to the differences in their effects on animals, some of them not being pathogenic in rabbits, and some, such as micrococcus pyogenes tenuis, being especially associated in man with mild inflammations.

In acute osteo-myelitis it is almost always staphylococci that are present, though it is possible that streptococci may also cause it. Although this fact cannot be used as an absolute diagnostic sign, nevertheless it is of great value. If streptococcus is found, say in a suppurating knee joint, the probabilities in favor of osteo-myelitis are less than if staphylococcus is present; and in one case of this kind, Krause made the diagnosis of the absence of osteo-myelitis from the presence of streptococci in a suppurating knee joint, a diagnosis fully confirmed by post-mortem examination.

Dose and Concentration of the Organisms.

Perhaps the most important factor on the part of the micro-organisms is the dose or number, and the concentration in which they enter the body. Ogston has already laid stress on the dose, as explaining the different diseases which result from the introduction of these organisms, and he looks on the difference between acute abscess and pyæmia as in the main a quantitative one. This, however, is only partially correct, as must now be evident.

Various authors have, from time to time, mentioned with regard to bacteria, that some act best or only when present in large numbers, but the matter has not till recently been thoroughly worked out. I was led to investigate this matter in connection with some interesting experiments made by Sir Joseph Lister, which appeared to show that one or a few putrefactive bacteria could not set up putrefaction in blood taken with various antiseptic precautions, while that result was obtained if a mass of putrefying material was added to it. At first sight I did not think that it could matter much, except as regards the rapidity of the result, whether, to begin with, one or a million bacteria were employed; but, nevertheless, I determined to put the matter to the proof, and, to my surprise, I found that difference in dose was a most important factor in the production and the type of many diseases. The experiments were made in such a manner that I was able to ascertain exactly the number of bacteria introduced, the material being, in the first place, diluted to such an extent that, on a rough estimation with the microscope, I obtained a general idea as to the number of bacteria present in a given quantity of the fluid; a known amount of this fluid was then injected into the animals, and at the same time a measured quantity was thoroughly mixed with liquefied nutrient jelly, which was then poured out on glass plates, and allowed to solidify. By counting the number of colonies of bacteria which developed on these plates, each colony probably originating from a single bacterium, I ascertained exactly how many organisms were present in the amount of fluid injected.

Experiments with Proteus Vulgaris.—Without going into further details, the following are the most important results that I obtained. In the case of Hauser's proteus vulgaris, I found that a definite and large dose of the cultivation in nutrient jelly was necessary to kill rabbits, and in comparing these doses I took care that they were always injected into the same tissue, *e.g.*, the muscles, in accordance with the facts previously mentioned with regard to the importance of the seat of inoculation. I found that about $\frac{1}{10}$ c.cm. of an undiluted cultivation was a rapidly fatal dose when injected into the muscles, and I ascertained that this quantity contained about 225 millions of bacteria; $\frac{1}{10}$ c.cm., containing therefore about 56,000,000 bacteria, always caused an extensive

abscess, of which the animals usually died in six to eight weeks. Doses of less than $\frac{1}{500}$ c.cm. produced no effect, in fact, doses of less than $\frac{1}{1250}$ c.cm., or in other words, fewer than 18,000,000 bacteria seldom caused any result. From $\frac{1}{1250}$ to $\frac{1}{40}$ c.cm. caused abscesses, above $\frac{1}{20}$ c.cm. caused death in twenty-four to thirty-six hours. Further, the size of the abscess apparently depended on the initial dose. If $\frac{1}{500}$ c.cm. caused any effect at all, it was only a slight trace of whiteness in the tissues which soon disappeared, while $\frac{1}{40}$ c.cm. caused a large and spreading abscess, ultimately resulting in the death of the animal, and intermediate doses produced abscesses intermediate in size. Further, the concentration of the bacteric material is also of great importance, as shown by the fact that the dose must act at the same place at the same time. It apparently will not do to split up the dose and inject various portions of it into different parts of the same animal at successive periods of time, or even at the same time. In both cases the effect of the smaller dose is produced.

Experiments with the Bacilli of Mouse Septicæmia.—I have tested this matter in the case of a number of other infective diseases, and have found that the result depended mainly on what we may, for want of better knowledge, term the predisposition of the animal to the disease. Thus, in the case of mouse septicæmia, mice, which are extremely susceptible to this disease, die as the result of the injection of a single bacillus; while the only result of the injection of 4 c.cm. of a jelly cultivation containing myriads of bacilli into the base of the ear of rabbits, is to cause illness for a few days, along with slight swelling and redness of the part.

Experiments with Chicken Cholera.—In like manner, in the case of chicken cholera, rabbits die apparently as the result of the introduction of a single microbe, but a considerable number—somewhere between 150,000 and 300,000—are required to cause the death of a guinea-pig; and here again we meet with the fact that where the animal is less predisposed to the disease, we have different effects, according to difference in the dose. As I have said, 300,000 bacilli are apparently able to kill guinea-pigs; as the result of a smaller dose, down to 10,000, abscesses form, while with less than 10,000 bacilli, apparently no effect is produced.

Experiments with Pyogenic Cocci.—In the case of staphylococcus pyogenes aureus, I have found that it was necessary to inject something like 1,000,000,000 cocci into the muscles of rabbits, in order to cause the death of the animal, while 250,000,000 produced a small circumscribed abscess. The same result was obtained with staphylococcus pyogenes albus, only apparently fewer cocci were required.

This is no doubt a large number, and does not say much for the pathogenic power of these organisms in rabbits. There is no doubt, however, that man is very much more susceptible to the staphylococci than rabbits, and consequently a very much smaller number will produce the same result in man. Besides, in the above experiments, there was no weak spot, and therefore all the conditions were unfavorable for their growth. Usually, however, in man there is a weak spot, and consequently the requisite dose is still smaller. These numbers apply to injection into the muscles; where the injection is into the subcutaneous tissues, much larger quantities are necessary to produce the same results.

Experiments with the Tetanus Bacillus.—In the case of the tetanus bacillus, death did not occur in rabbits when fewer than 1,000 bacilli were introduced.

Explanation of these Results.—I think that in these experiments a good deal depends on the simultaneous action of the products of the bacteria, and I would suggest the following explanation of the facts. When the animals are not very susceptible to the action of a bacterium, the cells and tissues soon gain the victory in the struggle for existence, but where a large number of bacteria are introduced at one place, they grow for a time before they are attacked by the cells, and growing there, each produces a small quantity of poisonous material. The products thus formed must interfere with the action of the cells, and thus enable the bacteria to gain a foothold. The greater the number of the bacteria introduced at one time, the greater will be the amount of these products, the more extensive the foothold, and the more marked the result. Where only one or a few bacteria are introduced into a slightly susceptible animal, they are overpowered by the cells and quickly destroyed. When the number of bacteria is greater, these poisonous products destroy the tissue in their vicinity, and enable the bacteria to spread over a large area

before the cells collecting around them are able to form an efficient barrier against their progress; and where the dose is very large, no efficient barrier can be set up in time, and the death of the animal is the result. Thus the extent to which the organisms spread, and the violence of their action in animals not very susceptible to the disease, depends firstly on the number of bacteria and the quantity of products introduced in the first instance, and secondly, on the vitality of the animal and the rapidity with which a granulation wall is formed.

Laws deduced from these Results.—The facts made out in this research enabled me to lay down the following laws: In the first place, the pathogenic dose of a virus varies inversely with the predisposition of the animal to the disease in question; the greater the predisposition the less is the quantity required, and conversely the less the predisposition the greater is the number of bacteria that must be introduced to produce the same effect. Of course the term "predisposition" is an absolutely indefinite one, but I have already discussed a number of conditions which go together to make up predisposition, and it is a convenient term as expressing a complex set of conditions, which undoubtedly exist, but about which we do not know very much. A second law is that in animals which are not very susceptible to a disease, the severity of the affection varies directly within certain limits with the amount of virus introduced. In all the affections of this class which I have investigated, I found three stages according to the quantity of virus injected: firstly, a stage, where with a small dose no apparent effect was produced; secondly, an intermediate stage, where a local affection resulted, the extent of the local affection depending to a great degree on the dose of the virus; and thirdly, a stage where, after a very large dose, death occurred. Of course, as predisposition varies in the same species of animal—for example in man—we cannot measure out the dose, nor calculate the effects of a given dose in each instance.

The importance of these facts as regards dose is very great in connection with our subject, for man is not very susceptible to the action of pyogenic organisms, and the results produced by them vary to a great extent in accordance with the second law. In the case of wounds, it is important to know that ap-

parently in man a single pyogenic coccus might possibly do no harm, unless, indeed, it met with conditions, such as retention of fluid, under which it could grow. At the same time, I doubt whether a single coccus ever enters a wound; as a rule, they occur in masses containing many cocci, and then of course we have the effects of a large dose. And further, there is no doubt that man is very much more susceptible to the action of these organisms than rabbits, and therefore a very much smaller dose will probably produce the same effect. The facts as regards dose probably explain to some extent the fairly good results obtained where, by imperfect attempts at antiseptic work, the introduction of gross particles of dirt, that is to say, of large numbers of organisms, is avoided, and where consequently the effect of the injection of a small instead of a large dose of a virus is obtained.

The importance of dose has, as I have said before, been mentioned by various observers. Thus Ribbert, in his research on experimental myocarditis and endocarditis already referred to, found that in order to obtain the desired result, it was necessary to inject a considerable quantity of the cultivations. Thus a Pravaz syringeful of the emulsion killed the animals in from twenty to twenty-four hours; if the dose was somewhat less, the animals might live even for five days; if only one-sixth of a syringeful was injected, the animals lived still longer, and endocarditis was not produced. In the case of symptomatic anthrax, the relation of dose to the production of disease is extremely marked, a small dose either producing no effect at all, or only local reaction, which, however, may suffice to render the animal immune; while a larger dose causes the death of the animal.

Virulence.

It is also important to remember that organisms may vary in virulence at different times, and that the greater the virulence of the organisms, the less are other conditions necessary to enable them to gain a foothold. A virus (or at any rate most viruses) is, as regards virulence, not a fixed quantity; it is, in fact, in a constant state of variation, under the influence of the external conditions under which it finds itself. I need not refer to the well-known facts with regard to varia-

tions in virulence in the case of anthrax, chicken cholera, swine erysipelas, etc., as the result of variations in the mode of cultivation outside the body; but I may mention some of the points which seem to bear especially on the pyogenic organisms. In many cases it is found that, as the cultivations carried on outside the body become older, so the virulence of the organisms is apt to decrease. This is very well seen in the case of Fraenkel's pneumonia coccus, which loses its virulence within two or three days when grown in the same medium outside the body, and which, if its virulence is to be maintained, must be re-inoculated frequently, and passed from time to time through the animal body. It can be readily seen, also, that staphylococcus pyogenes aureus grows most luxuriantly in the early cultivations from the body, but after it has been artificially cultivated for some time, its growth is by no means so rapid. Emmerich states, with regard to cultivations of erysipelas cocci, that they vary much in virulence, and that the longer the time between each fresh inoculation, the less is the virulence of the culture; in fact, the erysipelas cocci can be readily attenuated to such a degree, that they can no longer kill mice.

It is important, also, to remember that where the virulence of an organism is diminished, its effects on animals vary in accordance with the second law; thus, if a considerable number of attenuated anthrax bacilli are injected into rabbits, the result will be, not a general fatal disease, but a local inflammatory affection, with possibly the production of an abscess, varying in size to a certain extent with the amount of virus injected. In fact, the effect of the attenuated organisms on animals highly susceptible to the virulent virus, is the same as if virulent organisms were injected into less susceptible animals; and, consequently, in order to produce the same effect as with the virulent organisms, correspondingly large doses of the attenuated organisms are required. Thus Kitt and Hueppe have found that they could obtain the same result by injection of the organisms of an infective disease of deer into animals, if, as the organisms lost their virulence, they increased the number of microbes injected. These facts are also important as showing how, even in a mild epidemic of a disease, where the virulence of the virus is not very great, bad cases may occur where extra large doses of the virus have

been taken in, and this is probably in part the explanation of the occurrence of isolated severe cases in the course of a mild epidemic.

It is further important to note that loss of virulence may not only be due to the ordinary conditions of growth, but may also result from the action of various chemical substances. Thus carbolic acid and other antiseptics apparently diminish the virulence of anthrax bacilli, and it is possible that something of the same kind occurs with regard to the pyogenic cocci in wounds; and this may to some extent explain why, at the present day, although pyogenic cocci occasionally enter wounds treated aseptically, they sometimes do but little harm, less harm, in fact, than when they enter wounds in the treatment of which these antiseptics are not employed. It is quite possible that in growing in fluids containing a minute amount of an antiseptic, they are deprived, at any rate to some extent, of their virulence.

Increase in Virulence.—As regards increase of virulence, a very curious observation has been made in reference to the bacilli of symptomatic anthrax. It has been found that the addition of a minute quantity of lactic acid to a fluid containing these bacilli, increases the virulence of a very attenuated virus within a very short time. Thus Arloing, Cornevin, and Thomas found that if to a fluid containing these bacilli $\frac{1}{500}$ part of lactic acid is added, and the mixture allowed to stand for twenty-four hours, the pathogenic power is increased twofold; if, then, a little water containing a very easily fermentescible sugar is added to the mixture, and another twenty-four hours allowed to elapse, the virulence has attained its maximum; and frogs inoculated with this virus die in from twelve to fifteen hours, whereas, when inoculated with ordinary virus, they live forty to fifty hours. Kitt has repeated and confirmed these experiments, and he mentions the following: A small quantity of the vaccine material, *i.e.*, the attenuated virus of symptomatic anthrax, was divided into two parts, of which one was mixed with water and injected into two guinea-pigs, while the other was mixed with the same quantity of water to which three drops of lactic acid had been added; this mixture, after standing for six hours, was injected into the other two guinea-pigs. The result was that the first two guinea-pigs remained well, the virus being very atten-

uated, while the last two guinea-pigs died of typical symptomatic anthrax within twenty-four hours. With regard to this point, it is worthy of note that the pyogenic cocci when grown in milk, for example, produce lactic acid; but, so far as I am aware, there is no evidence that under these circumstances their virulence is altered. Something of this kind may, however, be the explanation of Ogston's results; he found that if pyogenic cocci were grown in eggs, their virulence was increased, and he attributed this result to the absence of oxygen. I tested this matter, with regard to the possible alteration in virulence when grown in various gases, without being able to make out any noticeable difference; but it may be that, in Ogston's experiments, some chemical substance was present in the egg, or was produced by the organisms when growing in that material, which led to the increase in virulence. The fact with regard to lactic acid does not apply to the coccus of pneumonia, which, according to A. Fraenkel, loses its virulence most quickly when grown in milk, and, in his opinion, this is due to the presence of lactic acid produced by this organism. Whether or not this fact has any bearing on our subject, it is worth remembering, as showing what slight and unexpected causes may alter the virulence, and thus cause a difference in the result of the action of these organisms.

Virulence may also be increased or diminished by passing the organisms through certain animals. Thus, according to Pasteur, the bacilli of swine erysipelas are weakened by passing through rabbits, and strengthened by passing through pigeons; and according to Arloing, Cornevin, and Thomas, Rauschbrand bacilli may be strengthened by passing through quite young guinea-pigs (one to three days old). It is quite possible that something of the same kind may happen in the case of the pyogenic or erysipelas cocci, and that they may leave certain individuals in a more or less virulent condition than when they entered them.

Concurrent Growth with other Bacteria.

We have also to consider the effect of the concurrent growth with other bacteria, and we shall find that the result may be either to increase or diminish the pathogenic action; in man, in all probability, the pathogenic action of the pyogenic

organisms is generally increasd. When two organisms grow together in the same medium outside of the body, they either do not interfere with each other, or, what perhaps most frequently happens, one of them gains the upper hand in the struggle for existence, and if a number of bacteria gain access to a wound, a struggle for the mastery at once commences between the different kinds. In wounds this struggle, in most cases, probably results in favor of the pyogenic cocci, and as the result of the concurrent growth, other factors come into play which still further aid their action.

As a rule, the foul smell of a wound is greatest within a few days after it has been made, and it generally decreases as time goes on, especially if the drainage is good; in other words, the putrefactive bacteria gradually cease to exert their action.

Thus, although the pyogenic cocci gain the upper hand, the putrefactive bacteria may aid their action very much, for the products of putrefaction when absorbed act in an extremely poisonous manner, depress the vitality of the patient, and may thus enable the cocci to live in the body; and locally these products injure the young granulation tissue of the wound, and thus may open up an entrance for the pyogenic organisms. I have already referred to the experiments made by Grawitz and Scheuerlen on cadaverine and putrescine, and it will be remembered that these experiments showed that these substances, when present along with the pyogenic cocci, enabled the latter to obtain a foothold in the body. The bad effects resulting from the concurrent growth of different kinds of bacteria are also very evident in tubercular cases. If a sinus leading to carious bone, the wall of which is lined with tubercles containing tubercle bacilli, becomes the seat of development of these pyogenic cocci, the result may be—in fact, generally is—a more rapid growth of the tubercle bacilli; and it seems that it is just in these septic cases, especially where irritating injections are also employed, that the danger of further and general tubercular infection is greatest; the local depression of vitality produced by the septic organisms enabling the tubercle bacilli to grow more luxuriantly.

Mixed Infection.—Then also, in some instances, it appears that a mixed infection is more dangerous than infection with one species of organism. Thus, in some cases, the presence of

more than one kind of pyogenic organism apparently increases the severity of the suppurative process. Kraske, for example, has observed in acute osteo-myelitis that the cases were most severe when the infection was a mixed one—that is to say, when the disease was caused not only by the staphylococcus pyogenes aureus, but where, in addition, albus, and in some cases the streptococcus pyogenes were also present; and as a result of his observations he thinks that the discovery of mixed infection in acute osteo-myelitis ought to lead to a bad prognosis. Probably also one reason why we so seldom at the present day see the extremely bad septic cases formerly described is that, even where the treatment is not thoroughly aseptic, such precautions are taken as to exclude not only gross masses of dirt, in other words large numbers of the organisms, but also a great mixture of them. And this is possibly also, in part, the reason why, in my first work on this subject, I was led to think that bacilli were of more importance in wounds than micrococci, for I observed that the wounds in which both organisms were present did not pursue so favorable a course as where the cocci alone were found.

Antagonism of certain Bacteria.—Apparently, however, in some cases the presence of two species of pathogenic organisms is better for the animal than if only one species is present, and although the facts as yet made out have no direct bearing on the production of suppuration, yet, as they are of great interest, and as something similar may occur in the case of the pyogenic cocci, I shall mention some of the experiments. A number of observers have attempted to utilize the antagonism which exists between certain species of bacteria in cultivations outside the body as a means of cure when the body is attacked by organisms, but till quite recently these attempts have not been followed by success. Emmerich, however, has lately performed some very remarkable experiments on rabbits, showing the value of the erysipelas cocci as a protective and curative agent in these animals; for example, in one set of experiments rabbits were first inoculated with large numbers of the cocci of erysipelas, and then two to fourteen days later anthrax bacilli were introduced. Of fifteen animals treated in this way seven recovered, while all the control animals inoculated with anthrax alone died; of the seven animals which died after inoculation of both organisms some

succumbed to the anthrax bacillus and some to the erysipelas organism. The results were not so successful when, after anthrax had been set up, and after symptoms of disease had appeared, erysipelas cocci were injected subcutaneously, but they were somewhat better when the erysipelas cocci were injected into the blood stream.

In one set of experiments anthrax was first induced in sixteen animals, and when the symptoms of the disease had appeared erysipelas cocci were injected subcutaneously. Of these only two recovered. In three sets of experiments where half a million anthrax bacilli were injected into each animal, and where subsequently erysipelas cocci were introduced into the veins, the animals thus treated recovered, though after a long illness; while those kept for control, without the injection of the erysipelas cocci, all died.

In a later paper Emmerich and Mattei communicated results obtained by injecting erysipelas cocci into the circulation and subcutaneously in rabbits about twenty-four hours before infection with anthrax. They found that in rabbits in whose bodies large numbers of erysipelas cocci were present, anthrax bacilli, though injected in enormous numbers, were destroyed in from twelve to seventeen hours, and could not be found either at the seat of injection or in the blood and internal organs, whether by microscopical examination or by cultivation; the bacilli were evidently unable to penetrate into the blood and internal organs, nor could they cause any local reaction or œdema, in fact, they very quickly died out. Perhaps still more remarkable are the experiments performed by Pawlowski. He found that after injection of a mixture of erysipelas cocci and pure cultivations of anthrax bacilli under the skin of seven rabbits only two died. Pawlowski has also made the important discovery that the erysipelas coccus is not the only organism which interferes with the growth of anthrax in the body. Thus ten rabbits were first inoculated with anthrax bacilli and then cultivations of micrococcus prodigiosus were injected subcutaneously into each animal on two occasions, two and twenty-four hours after infection; of these ten animals eight recovered. He also found that subcutaneous injection of anthrax bacilli and cultivations of the pneumonia cocci was not fatal to rabbits, and that subcutaneous injection of cultivations of anthrax bacilli and staphylococcus

pyogenes aureus was not followed by the death of the animal; four rabbits treated in this way recovered.

As to the explanation of these facts, Emmerich and Pawlowski come to very much the same conclusion. Apparently, with the exception of the pneumonia coccus, anthrax bacilli grow readily outside the body in cultivations containing also the other organisms mentioned, such as the erysipelas cocci. Hence the explanation cannot be that the erysipelas cocci *per se* prevented the growth of the anthrax bacilli in the body. It seems to be rather that these cocci irritate the cells of the body, the phagocytes, and increase their destructive power; it may be, as Emmerich suggests, that this irritation leads to a slight alteration in their physiological functions, so that they excrete some chemical substance which is very injurious to the anthrax bacilli.

How far these acts may be applied to the treatment of anthrax pustules in man, where, either from the situation or the size of the pustule, excision or cauterization are impracticable, is a question very difficult to answer, and it seems to me that we must await the results of further investigations before any attempt to apply them practically in man would be justifiable. In any case, the facts are well worthy of note as affording another example of what unexpected factors may come into play if we once admit micro-organisms to wounds.

Local and Seasonal Conditions.

Lastly, we have certain local and seasonal conditions which appear in some way or other to influence the occurrence of some of these diseases. For example, Eschbaum, who has gone into this matter very carefully, finds that spontaneous erysipelas occurs most often apparently in February, then next most frequently in November, and least freqently in July. Apparently the cold months, and those where there is most moisture and greatest variations in temperature, show the greatest number of cases, and Eschbaum summarizes the facts by saying that the cases are most numerous when we have marked variations of temperature, with a medium height of the barometer and a high degree of moisture. In the case of diphtheria also, cold and moisture seem to be a great predisposing cause, most cases occurring about the months of

November and December. Kocher and Lücke have found that acute osteo-myelitis also is most frequent in winter. Probably, besides the seasonal conditions, the confinement in badly ventilated rooms, foul air and want of exercise, which come into play more frequently in cold and wet weather than in summer, have an important influence on the result. In the case of diseases of animals, more especially in the case of anthrax, there is a very marked relation between the season and the outbreaks of the epidemic, the disease apparently occurring where there is great moisture and high temperature. As regards anthrax, Chauveau has shown that increased atmospheric pressure tends to cause a loss of virulence.

As an example of the influence of locality on these suppurative diseases, we have the greater frequency of acute osteomyelitis in certain parts. For example this disease seems to be more frequent in Berne than anywhere else, and, according to Volkmann, it occurs next most frequently in Halle, and then in Marburg. These, however, are rather impressions than actual statistical facts.

Summary.

We thus come to the end of our considerations with regard to the factors involved in the production of suppuration and septic diseases. It must be admitted that our knowledge still shows many blanks, but nevertheless enough has been gained to enable us to judge what are the essential factors which come into play. That the pyogenic organisms are absolutely essential for the production of these diseases there can no longer be any doubt, but in many cases much depends on other conditions, of which the chief, probably, are the dose or number of the organisms and their concentration, general and local depression of vitality, and the seat of inoculation. If the organisms enter in large numbers sufficient to overcome the resistance of the body, they alone may cause the disease; usually, however, they enter in smaller numbers, and then other conditions become necessary in order to enable them to act. Of these conditions, the chief are, as I have said, depressed vitality, either local or general, combined with the possibility of their remaining in the weakened tissue. This depression of vitality may be brought about by conditions

acting on the body generally, such as acute fevers; or by local conditions, more especially those which induce the early stage of inflammation, such as cold, injury, chemical substances, the products of the bacteria themselves, or the products of other kinds of bacteria which may happen to be growing along with them. Or again, the favorable condition may be some peculiarity in the soil as shown by variations in the character of the disease in accordance with the seat of inoculation and the anatomical arrangement of the part. The only factor, however, as I have said before, with which we can reckon with certainty, is the cocci themselves.

The whole matter is, as we have said, a battle between the tissues and the parasites, and may perhaps be best understood by comparing it with the warfare—especially with the sieges—of olden times. The opposing forces are, on the one hand, the bacteria, and, on the other hand, the body—the body representing the citadel, the cells of the body the garrison. Each of these forces has its own weapons. The weapons of the bacteria are, in the first place, poisonous substances which they throw into the body, and in the second place, starvation by withdrawing necessary materials from the body; the weapons of the body are less known; they are probably partly passive in the way of supplying bad food, and partly active in the production of ferments, in setting up digestive processes, and in withdrawing oxygen and other necessary substances from the parasites. If the parasites attack in large numbers and suddenly, they may carry the citadel before the guards—that is to say, the cells—become aware of their presence, and have time to turn their attention to the threatened part; or it may be in other cases they merely make a serious breach in the defences in which they can establish themselves, and from which they can send poisonous materials into the body, and gradually destroy it. If they are in too small numbers, they either fail to make their way into the body at all, or if they do get in, they cannot escape the guards, and are overpowered and destroyed. If the attack is only partially successful, the result is to irritate instead of destroying the defending agents, and these ultimately completely block the way or surround the parasites, which die and are cast out. This is seen in defensive inflammation, the object of which is to prevent the spread of the organisms by

erecting a barrier through which the infective agents cannot pass; in order to do this some tissue must be sacrificed in the neighborhood of the bacteric deposit, just as it is sometimes necessary to pull down houses around a fire to prevent its spread. In the concurrent action of different species of bacteria, we have an example of warfare with allied forces. The new assistants may be of great value by their peculiar method of attack, taking the garrison unawares, for example, and thus admitting the other assailants. We have an example of this in the combined action of putrefactive and pyogenic bacteria, the putrefactive by their products weakening the tissues and breaking down their resistance, and thus enabling the others to enter. Or again, the reverse may be the case, and, like the erysipelas cocci and the anthrax bacilli, they may increase the power of the guards, or by greater vigor of growth they may crowd out the pathogenic organisms, while being themselves little, if at all, virulent.

I need not enter into details as to the pathology of all the various suppurative and septic diseases, it will be easy for any one to apply the facts which have been stated to each disease, but in conclusion, I wish to make a few remarks with regard to the mode of entrance of these organisms into wounds.

Occurrence outside the Body.—These organisms are fairly widely distributed outside the body. In the air they have only been found on a very few occasions, and in very small numbers. The staphylococcus pyogenes aureus has been found on one or two occasions in the air of surgical wards, as has also the streptococcus of erysipelas. Experiments have been made as to the presence of the latter organism in the air of wards in which erysipelas patients were present, and they have, in one or two instances, been found in small numbers; as a rule, however, they are apparently present only when the patients are convalescent, and when desquamation of the skin is occurring, and it seems highly probable from the observations that have been made, that they are carried in the cutaneous scales thrown off during desquamation.

Eiselsberg exposed gelatin and agar plates in various parts of wards for a certain length of time. Colonies of different kinds of organisms were found; in one instance staphylococcus pyogenes aureus. In a ward where there were four cases

of erysipelas, one of which was convalescent, he obtained a development of streptococci on two occasions. On testing these organisms by cultivation and experiments on animals, he found that they were Fehleisen's erysipelas cocci. In an isolation ward in which there was a patient with erysipelas of the face, which was almost well and desquamating, and of the back, which was in full vigor, agar plates were exposed, one of them being placed close to the head of the patient. In the latter plate only did the streptococcus of erysipelas develop. In five cases Eiselsberg has also made cultivations with the cutaneous scales of patients suffering from erysipelas, and in four of the cases cultivations of the streptococcus have been obtained.

Erysipelas cocci have also been found in a post-mortem room, where cases of erysipelatous infection had occurred, and in this case the infection was supposed to have come from the floor. The pyogenic organisms are very rarely present in putrefying fluids, but they have been found on decomposing beef and in the water employed in kitchens for rinsing dishes. They are also sometimes present in the superficial layers of the soil. One of their most common seats outside the body is the skin, and they especially occur in parts where the skin is moist—for example, in the axillæ, between the nates, between the toes, etc.; they are also frequently present in connection with the hair and in the dirt beneath the nails. Fraenkel has found them in the secretions of the healthy pharynx, and Bockhardt found aureus and albus in large numbers in the nasal mucus of a patient suffering from chronic catarrh of the nose, and at the same time affected with sycosis of the upper lip.

Mode of Entrance into Wounds.—As regards the entrance of these organisms into wounds, they may get in during an operation from the air, from the instruments and hands of the operator or his assistants, from surrounding objects, or from the skin in the neighborhood of the wound. We are now, however, sufficiently acquainted with the various precautions necessary to prevent the entrance of these organisms, and it is a comparatively easy matter to keep a wound made through a previously unbroken skin free from pyogenic organisms.

Although it is theoretically possible that in some cases these organisms might enter wounds from the blood in un-

healthy subjects, I have never yet come across a case in which there was any ground for such a suspicion, nor where, when they were present, there was not a sufficient loophole for their penetration from without.

In the after-treatment of wounds, there are two situations where the battle with these parasites takes place; it may either occur outside the wound, the organisms never being allowed to enter it, or it may take place inside the wound after their entrance has been permitted. It is hardly necessary to remark that in case of war we try to carry the war into the enemy's country; at all events, we do all we can by guarding the passes and borders, to prevent the enemy from entering our own country. And in like manner, in the case of wounds, it seems to me that it is much better to keep these pyogenic organisms out of the wounds, and to do battle with them outside the body, than to let them enter and trust to the efficacy of the tissues to repel their attacks. For, once they have entered the wound, it is but little that we can do to aid the action of the body, and what little we do has to be done with extreme caution, for not uncommonly our efforts, instead of being of service, cause a great deal of harm. As I have said, it is comparatively easy now to keep these pyogenic organisms out of a wound while it is being made, and to leave the wound without any of these microbes in it; the problem is to prevent their entrance afterward. In this case, however, we have at any rate succeeded in transferring the field of battle from the interior of the wound to the surface of the body, and we have no longer to trust to the imperfect and but little understood action of the tissues; we can step in with vigorous action without any fear of doing harm. For it cannot be too much insisted on that antiseptic dressings are not in their essence applications to wounds; they are applications to the discharge which has come from the wound and to the skin around it.

The mode of entrance of these pyogenic cocci in cases of spontaneous acute abscesses, etc., is by no means clear in all cases. Where the abscesses occur in connection with lymphatic glands, there is no doubt that the organisms enter through wounds or inflamed patches on the cutaneous or mucous surface, are carried or grow along the lymphatic vessels, and are deposited in the lymphatic glands. In other cases, it is proba-

ble that the cocci are caught in the course of the lymphatic vessels, grow there, and set up an abscess. In other cases the suppuration occurs directly beneath a wound or prick in the skin, the cocci simply spreading in the tissue or being carried by the juices of the part. Again, they may enter as the result of inunction through the glands of the skin, or through abraded epithelium, as is seen so often in the case of boils and pustules. I believe that if statistical facts could be obtained, it would be found that in by far the greatest number of cases, the infective material comes from without, either spreading directly into the tissue, or being carried along the lymphatics and deposited at various parts, and that the number of cases in which infection occurs from the blood is very small indeed. Where the infection occurs from the blood, the cocci reach the blood either from wounds or defects on the surface of the body, or from previous inflammatory deposits such as boils. I think it must be very seldom that these organisms enter through uninjured mucous membrane, though apparently in some cases no defect of the surface or inflamed area can be observed.

As to the mode of entrance of these pyogenic cocci after an operation, they may get in while the dressing is being changed, either by falling in from the air—though this must be of rare occurrence, seeing that they are so rarely present in the air—or by contamination by the surgeon's hands, instruments, etc., but this is also very easily avoided and ought not to occur; usually they spread in, either through the dressings or beneath them, in the intervals between the change of dressings. In my opinion, they most commonly spread in by growing in the discharge which is lying between the dressings and the skin, and in the superficial layers of the epidermis, more especially in the latter: for as the result of the irritation of the antiseptic employed, there is hypertrophy of the epithelium, and thus a large number of dead epithelial cells is present, which, being soaked with the discharge, form a good nidus for the development of the bacteria, unless, indeed, enough of the antiseptic has been communicated to the discharge and the epithelium from the dressing to render it an unsuitable soil for the growth of organisms. If this is not the case, the organisms will go on growing in the substance of this dead epithelium, protected by the superficial layers from the action

of the dressing, and thus they may, if a dressing is left on for too long a time, ultimately reach the wound. This is not a mere theoretical speculation, for I have been able to trace the development of the organisms beneath the dressings from their margin toward the wound, the extent to which they spread varying with the length of time that the dressing has been applied. If these views as to the mode of entrance of bacteria into wounds are correct, it follows that it is very important, when a dressing is changed, to wash and thoroughly disinfect the skin around the wound as far as the dressing extended, and beyond it, with an antiseptic lotion, care being of course taken, by covering up the wound, not to infect it while so doing. If this is done, then at each change of dressing the field of battle is transferred from the neighborhood of the wound to the margin of the dressing, and, in accordance with the size of the dressing, this battlefield will be at a greater or less distance from the wound.

At the present time there are various kinds of dressings by which completely aseptic results can be obtained. I may mention the method which I now employ, and which for some time past has yielded uniformly good results.

The instruments are placed in 1:20 carbolic solution for half to one hour before the operation. This is quite sufficient to destroy the cocci present on them and most of the bacilli which may adhere to them are non-pathogenic in man, and cannot develop in healthy wounds. Besides, as the instruments are being constantly placed in 1:2,000 sublimate solution during the operation, and the wounds are irrigated with sublimate solution, even the spores of the bacilli are destroyed. As a matter of fact, almost the only bacillus which we have to fear is the tubercle bacillus, and, therefore, if I have several operations at one time, I always take the tubercular cases last, lest in using the same instruments (forceps, etc.) after they have become infected with tubercular material I should infect another wound.

The hands of the operator and his assistant are thoroughly disinfected with 1:20 carbolic lotion, and then with 1:2,000 sublimate solution, a nail brush being freely used.

The skin in the neighborhood of the seat of operation is thoroughly washed with 1:20 carbolic solution in which corrosive sublimate in the strength of 1:500 is dissolved. After

wetting the skin with this solution I generally soap it, and then scrub it thoroughly with a nail brush, hairs being shaved off when present.

The sponges are kept permanently in 1:20 carbolic lotion, and washed in 1:2,000 sublimate solution during the operation.

The operator has a basin of 1:2,000 sublimate solution at hand, in which he frequently dips his instruments and hands during the course of the operation.

The parts (clothes, etc.) around the seat of operation are covered with towels wrung out of 1:2,000 sublimate lotion.

No spray is employed, but the wound is irrigated from time to time, and constantly when stitching it up, with 1:2,000 sublimate solution. In operations on joints and bones I irrigate the wound during the whole operation with 1:4,000 sublimate solution.

As a dressing I apply first a large piece of carbolic gauze (about four layers in thickness), which is always kept in a jar of 1:2,000 sublimate solution. Next a mass of alembroth gauze moistened, but not washed, in 1:2,000 sublimate solution. (The reason for using the carbolic gauze is that if the alembroth gauze is applied next the skin it is apt to cause irritation, and even blistering of the skin, and to wash out the alembroth from the deeper layer of gauze, and thus to apply aseptic gauze not containing any store of the antiseptic next the skin is, I believe, a dangerous thing, for the sublimate from the outer part may not soak back into the discharge on the surface of the skin and into the superficial layer of epithelium in sufficient quantity to prevent the growth of micro-organisms.) Outside this I apply a large mass of salicylic wool which permits drying of the deeper parts, adds to the thickness of the dressing, and being less absorbent than the gauze, leads to the diffusion of the discharge throughout the gauze in the same manner as was formerly done by the mackintosh.

In some cases it is advisable to apply a narrow strip of protective over the line of union. I also use drainage tubes less frequently than formerly. In most cases where by moderate pressure the deeper parts of the wound can be kept in contact I do not use a drainage tube, but incorporate one or more large soft sponges with the dressing, and very often never change the dressing for ten or fourteen days, and then find the wound quite healed. A continuous suture of catgut

applied like a button-hole stitch is often preferable to the interrupted suture.

There are a number of other materials which yield good results, and their number will probably be soon increased, but the methods of dressing described yields, as I have said, uniform aseptic results, which leave nothing to be desired except greater simplicity.

I shall not enter any further into the subject of the treatment of wounds. We have now at our command a large number of antiseptics which more or less answer the purposes required, and it is only by careful attention to the exclusion of these organisms that we can obtain the best results. That we can completely exclude these bacteria from wounds, both at the operation and afterward, I have been able to ascertain by numerous experiments and observations; and that just in proportion as we are successful in so doing we are to a like degree freed from the occurrence of suppuration and septic diseases, and can, to a like degree, reckon with confidence on rapid and painless healing of wounds with the least disturbance to the patient is a matter now of every-day observation.

PHARMACOPŒIA

FOR

DISEASES OF THE SKIN,

INCLUDING

FORMULA, BATHS, RULES OF DIET, CLASSIFICATION, AND THERAPEUTICAL INDEX.

EDITED BY

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PHARMACOPŒIA FOR DISEASES OF THE SKIN.

CHAPTER I.

PHARMACOPŒIA FOR DISEASES OF THE SKIN.

THIS publication will be found useful for the following reasons, viz.:

1st. A concise formula facilitates extemporaneous prescribing and reduction of the quantities in the drugs.

2d. A condensed summary or classification is helpful to the student or medical practitioner who may be unacquainted with the ordinary nomenclature of diseases of the skin, and would aid him in the application of the remedies suggested.

3d. Subjoined to each prescription is a note of the uses to which it is practically applied at the hospital, in the treatment of the different affections indicated, affording ready reference to the tabular statement for the name and nature of the disease as commonly designated.

4th. A therapeutic index, giving various medicines and drugs commonly used in the treatment of skin eruptions, not mentioned in the subjoined formulæ.

In addition, as diet plays such an important part in the treatment of diseases of the skin, I have considered it advisable to add a few simple rules on the subject.

It should be borne in mind that very few eruptions are comprised in any single manifestation, as cited in the classification, but that two or more are commonly found in combination, either at their commencement or during their course; viz., the sebaceous and squamous, the vesicular, pustular, and ulcerous are often blended with each other.

One single source of irritation may produce every form of cutaneous disease in differently predisposed individuals;

scabies, for instance, produces the vesicular, papular, pustular, and squamous eruptions; syphilis also furnishes all kinds of manifestations, providing a means of diagnosis upon which, in this as in every other affection of the skin, a successful treatment chiefly depends.

In conclusion of these remarks it is only necessary to mention that where combination exists in the manifestations of disease, combined remedies will be needed, and that internal medicines, in the majority of instances, will be required in conjunction with external agents, to promote a successful result.

Balnea.

There are two kinds: the vapor and the simple medicated liquid bath, which can be made to resemble in character most of the natural mineral waters. These baths admit, not only of having the temperature raised or depressed at pleasure, but can be medicated with various drugs, according to the nature and requirements of the case.

These baths are used chiefly for the purposes of bringing about a healthy action of the skin, and for the removal of scales. They also relieve irritable conditions of the skin, and allow the more thorough application of drugs. They are especially valuable in parasitic and syphilitic affections.

Scale of Temperature of Baths.

Bath.	Water.	Vapor.	Air.
Cold.....	33°– 65° F.		
Cool.....	65°– 75° F.		
Temperate...	75°– 85° F.		
Tepid.....	85°– 92° F.	90°–100° F.	96°–106° F.
Warm.....	92°– 98° F.	100°–115° F.	106°–120° F.
Hot.....	98°–112° F.	115°–140° F.	123°–170° F.

The Simple Vapor Bath.

Is a very valuable adjunct in many diseases of the skin. The bather seats himself on a chair, in a box (the cabinet Turkish bath being the best invention of the kind), or on a cane-bottomed chair, surrounded by a blanket, with a spirit or gas condenser under the seat. The temperature can be raised at will, from 90° to 100°.

The Turkish bath is very much the same in its process. The bather may remain in the bath twenty minutes to half an hour.

The Sulphur Vapor Bath.

This bath is made by adding one or two ounces of precipitated sulphur on an evaporating dish in the ordinary vapor bath, simultaneously with the steam; so that the drug and vapor surround the patient's body.

The Mercurial Vapor Bath.

This bath is made by adding 20 or 30 grains of pure calomel in the evaporating dish, as in the previous bath.

Balneum Acidum.

℞ Acidi nitrici, ... ℥ iss.
Acidi hydrochlorici, ... ℥ i.
Aquæ, ... ad Oi.
Modus, ... Oi. ad aquæ Cxxx.
Misce.

Useful in chromatic, papular, pruriginous, and squamous affections.

Balneum Alkalinum.

℞ Sodæ carbonatis, ... ℥ iv.
Aquæ ferventis, ... ad Oi.
Oi. ad aquæ Cxxx.
Misce.

Useful in corneous, papular, and squamous affections.

Balneum Boracis.

℞ Sodæ biboratis, ... ℥ iv.
Aquæ ferventis, ... ad Oi.
Oi. ad aquæ Cxxx.
Misce.

Useful in parasitic and pustular affections, and those eruptions where there are scales and crusty formations.

Balneum Creasoti.

℞ Creasoti optimi, ... ʒ ij.
Glycerini (Price's), ... ℥ ij.
Aquæ ferventis, ... ad Ci.
Ci. ad aquæ Cxxx.
Misce.

Useful in papular, squamous, and vesicular affections.

Balneum Glutini.

℞ Glutini præparati (vulgo, patent size), . lb. viij.
Aquæ ferventis, ... ad Cxxx.
Misce.
Useful in erysipelatous, squamous, and vesicular affections.

Balneum Sulphuris Compositum.

℞ Sulphuris precipitati, ... ℥ ij.
Sodii hyposulphitis, ... ℥ i.
Acidi sulphurici diluti, ... ℥ ss.
Aquæ, ... ad Oi.
Oi. ad aquæ Cxxx.
Misce.
Useful in parasitic, papular, and squamous affections.

CAUSTICA.

Causticum Hydrargyri Nitratis Acidi.

℞ Hydrargyri, ... ℥ i.
Acidi nitrici (s. g. 1.40), ... ʒ ij.
Misce.
Useful chiefly in destroying new growths, such as lupus, syphilis, and in ulcerous, tubercular, and structural affections.

Causticum Argenti Nitratis.

℞ Argenti nitratis, ... ʒ i.
Spiritus ætheris nitrici, ... ℥ i.
Misce.
Useful in erysipelatous, vesicular, and ulcerous affections.

Causticum Arsenicalis Compositum.

℞ Hydrargyri chloridi, ... ℥ iiss.
Hydrargyri bisulphureti, ... ʒ ij.
Acidi arseniosi, ... ʒ i.
Misce.
Useful in cancerous, ulcerous, and strumous affections.

Causticum Depilatorium.

℞ Barii sulphureti, ... ʒ iij.
Sodii sulphureti, ... ʒ ij.
Calcis recentis, ... ʒ v.
Pulveris amyli, ... ʒ ix.
Misce.
Useful in destroying hirsute and structural affections.

Causticum Acidi Chromici.

℞ Acidi chromici, ... grs. L.
Aquæ, ... ad ℥ ss.
Misce.

Useful in destroying low forms of ulceration.

Causticum Zinci Chloridi Compositum.

℞ Zinci chloridi, ... ʒ iv.
Antimonii chloridi, ... ʒ ij.
Pulveris amyli, ... ʒ i.
Glycerini, ... q. s.
Misce.

Useful in cancerous, structural, tubercular, and ulcerous affections.

Causticum Potassæ Compositum.

℞ Potassæ fusæ, ... ℥ ss.
Calcis recentis, ... ℥ ss.
Glycerini, ... q. s.
Misce.

Useful in destroying structural, ulcerous, and tubercular affections.

Causticum Sodii Ethylati.

℞ Sodii ethylati, ... ʒ i.
Ethylic alcohol, ... ℥ i.
Misce. (Dr. Richardson's formula).

Useful in destroying surface tubercles, new growths, and superficial nævi.

LOTIONES.

Lotio Acidi Nitrici.

℞ Acidi nitrici diluti, ... ℥ ss.
Tincturæ myrrhæ, ... ʒ ij.
Aquæ, ... ad Oi.
Misce.

Modus ℥ i. ad aquæ ℥ i. vel ℥ iij.

Useful in papular, ulcerous, and neuralgic affections.

Lotio Argenti Nitratis.

℞ Argenti nitratis, ... grs. viij.
Aquæ destillatæ, ... ad ℥ ij.
Misce.

Useful in erysipelatous, ulcerous, and vesicular affections, especially in chronic eczema, and indolent ulcers.

Lotio Bismuthi Composita.

℞ Bismuthi nitratis, ... ℥ ss.
Zinci oxidi, ... ℥ ss.
Spir. camphoræ, ... ℥ ss.
Glycerini, ... ℥ ss.
Aquæ, ... ad Oi.
Misce.

Useful in irritable conditions of the skin, vesicular and ›aceous affections.

Lotio Carbolici.

℞ Acidi carbolici, ... ʒ ij.
Spiritus vini rectificati, ... ʒ ij.
Glycerini, ... ʒ ij.
Aquæ, ... ad Oi.
Misce.

Useful in pruriginous and vesicular affections.

Lotio Carbonis Detergens.

℞ Liquor. carbonis detergentis, . . . ʒ ij.
Aquæ, ... Oi.
Misce.

Useful as a soothing wash in all vesicular and constitu-nal affections.

Lotio Cupri Sulphatis.

℞ Cupri sulphatis, ... ʒ i.
Aquæ, ... ad Oi.
Misce.

Useful in sloughing ulcers and syphilitic sores.

Lotio Hydrargyri Perchloridi Composita.

℞ Hydrargyri perchloridi, ... ℈ ij.
Acidi carbolici, ... ʒ i.
Spiritus vini rectificati, ... ʒ ij.
Glycerini, ... ℥ ss.
Aquæ, ... ad Oi.
Modus, ... ℥ i. ad ℥ ii. vel ℥ iij.
Misce.

Useful in all parasitic affections, ringworm, scabies, pity-sis, and freckles.

Lotio Nigra.

℞ Hydrargyri bichloridi, ... ʒ i.
Liquoris potassæ. . . . . ʒ i.
Aquæ, ... ad Oi.
Misce.

Useful in syphilitic and chronic ulcerous condition of skin.

Lotio Plumbi.

℞ Liquoris plumbi acetatis, ... ʒ iiss.
Glycerini, ... ℥ i.
Aquæ, ... ad Oi.
Misce.

Useful in erysipelatous and vesicular affections.

Lotio Sulphuris Composita.

℞ Sulphuris precipitati, ... ʒ ij.
Hydrargyri bisulphatis, ... grs. x.
Spiritus camphoræ, ... ʒ ss.
Glycerini, ... ℥ ss.
Pulveris amyli, ... ʒ ij.
Aquæ, ... ad Oi.
Misce.

Useful in papular, vesicular, parasitic, and pustular affections.

Lotio Zinci Composita.

℞ Zinci oxidi, ... ℥ ss.
Pulveris calaminaris (Corbin), . . . ʒ i.
Glycerini, ... ℥ i.
Liquoris calcis, ... ℥ viij.
Aquæ, ... ad Oi.
Misce.

Useful in all vesicular, papular, and pustular affections, and any acute inflammation of the skin.

MISTURÆ.

Mistura Acida Aperiens.

℞ Magnesiæ sulphatis, ... ℥ iij.
Acidi sulphurici diluti, ... ʒ iij.
Extracti glycyrrhizæ, ... ʒ i.
Aquæ ferventis, ... ad Oi.
Misce. Dosis ʒ ij. ad ℥ ss. ex aqua.

Useful in vesicular and parasitic affections; and as an ordinary aperient.

Mistura Acida.

℞ Acidi nitrici diluti, ... ℥ ss.
Acidi hydrochlorici diluti, ... ℥ ss.
Infusi quassiæ compositi, . . . ad Oi.
Misce. Dosis ʒ ij. ad ℥ ss. ex aqua.
Useful in herpetic, squamous, and papular affections.

Mistura Alkalina.

℞ Potassæ bicarbonatis, ... ʒ vi.
Potassæ chloratis, ... ℥ ss.
Glycerini, ... ℥ ss.
Aquæ ferventis, ... ad Oi.
Ess. carui vel menth. pip., . . q. s. ad flav.
Misce.
Useful in pustular and aphthous affections.

Mistura Alkalina Purgans vel Alba.

℞ Magnesiæ sulphatis, ... ℥ v.
Magnesiæ carbonatis, ... ℥ ss.
Sodæ bicarbonatis, ... ʒ vi.
(Tincturæ colchici [when required], . . ℥ i.)
Olei menth. piperitæ, ... ♏ x.
Aquæ, ... ad Oi.
Misce. Dosis ʒ ij. ad ℥ ss., ex aqua.
Useful in gouty and rheumatic affections, erythematous, papular, acute squamous, and vesicular affections.

Mistura Ferri Acida.

℞ Magnesiæ sulphatis, ... ℥ iij.
Ferri sulphatis, ... ʒ ij.
Acidi sulphurici diluti, ... ℥ ss.
Infusi quassiæ compositi, . . . ad Oi.
Misce. ʒ ij. ad ℥ ss. ex aqua.
Useful in anæmic, sebaceous, squamous, pustular, and ulcerous affections; and as an aperient tonic.

Infusum Quassiæ Compositum.

℞ Radicis quassiæ, ... ℥ i.
Radicis zingiberis, ... ℥ i.
Sp. chloroformi, ... ʒ ii.
Aquæ bullientis, ... Ci.
Macera per horas quatuor et cola.

Mistura Ferri Arsenicalis Acida.

℞ Acidi arseniosi, ... grs. iv.
Acidi hydrochlorici, ... ʒ ss.
Tincturæ ferri sesquichloridi, . . . ℥ ij.
Aquæ, ... ad Oi.

Misce. Dosis ʒ i. ad ʒ ij. ex aqua (℥ i. cont. gr. ¼ acid. arseniosi).

Useful in chronic squamous, vesicular, and pustular affections.

Mistura Arsenicalis Alkalina.

℞ Liquoris potassæ, ... ♏ x.
Liquoris sodæ arsenitis, ... ♏ v.
Sodæ bicarbonatis, ... grs. x.
Magnesiæ carbonatis, ... grs. v.
Aquæ menth. piperitæ, . . . ad ℥ i.

Misce.

Useful in gouty and rheumatic affections of the skin, or where acidity is concerned.

Mistura Hydrargyri Iodidi.

℞ Hydrargyri perchloridi, ... ☉ i.
Potassii iodidi, ... ʒ vi.
Tincturæ iodini compositæ, . . . ʒ ij.
Tincturæ cinchonæ compositæ, . . ʒ iv.
Aquæ, ... ad Oi.

Misce. Dosis ʒ i. ad ʒ ij. ex aqua. (ʒ i. cont. gr. $\frac{1}{18}$ hydrarg. bichlor. et gr. iij. pot. iod.)

Useful in syphilitic, cachectic, tubercular, ulcerous, and papular affections.

Mistura Ammoniæ Composita.

℞ Liquoris ammoniæ acetatis. . . . ℥ iv.
Ammoniæ carbonatis, ... ʒ ij.
Tincturæ digitalis, ... ℥ ss.
Tincturæ colchici, ... ℥ ss.
Misturæ camphoræ, ... ad Oi.

Misce. ʒ ij. ad ℥ i. ex aqua.

Useful in vesicular and phlegmonous eruptions complicated with thoracic and bronchial affections.

Mistura Potass. Iodidi.

℞ Iodini, ... 3 i.
Liquoris potassæ, ... ℥ i.
Áquæ, ... ad Ꝺi.

Misce. Dosis 3 i. ad 3 ij., ex aqua.

Useful in tertiary syphilis, tubercular, ulcerous, and pustular affections.

UNGUENTA.

Unguentum Carbolici Compositum.

℞ Pulv. zirci oxidi, ... 3 i.
Pulv. calaminaris, ... Ꝺi.
Acidi carbolici, ... ♏ x.
Unguenti hydrargyri nitratis, . . . 3 i.
Adipis benzoati, ... ad ℥ i.

Misce.

Useful in vesicular and acute inflammatory skin affections, and to allay irritation.

Unguentum Carbolici Forte.

℞ Acidi carbolici, ... 3 i.
Zinci oxidi, ... 3 i.
Adipis benzoati, ... ad ℥ i.

Misce.

Useful in vesicular, papular, and eczematous affections, particularly with local irritation.

Unguentum Carbonis Detergens.

℞ Liquor. carbonis detergentis, . . . 3 i.
Pulv. calaminaris, ... 3 i.
Pulv. zinci oxidi, ... 3 i.
Vaselini, ... ad ℥ i.

Misce.

This ointment is useful in the treatment of eczema, ulcers of the legs, and irritable eruptions, as lichen and prurigo.

Unguentum Creasoti Compositum.

℞ Plumbi oxidi vel carbonatis, . . . Ꝺi.
Hydrargyri oxidi rubri, ... Ꝺss.
Ol. palmæ purificati, ... ℥ ss.
Adipis benzoati, ... ℥ ss.
Creasoti, ... ♏ vi.

Misce.

Useful in eczema, and all squamous and vesicular eruptions.

Unguentum Hydrargyri Compositum.

℞ Hydrargyri ammon. chloridi, . . . ʒss.
Plumbi acetatis, ... ʒss.
Zinci oxidi, ... ʒi.
Unguenti hydrargyri nitratis, . . . ʒi.
Adipis recentis, ... ℥ss.
Ol. palmæ purificati, ... ℥ss.
Misce.

Useful in lichen and chronic eczema, and in squamous and ulcerous affections.

Unguentum Mercuriale Compositum.

℞ Hydrargyri oxidi rubri, ... grs. vi.
Hydrargyri ammon. chloridi, . . . grs. vi.
Adipis recentis, ... ʒi.
Misce.

Useful in papular, parasitic, sebaceous, and ulcerous affections.

Unguentum Rubrum.

℞ Hydrargyri bisulphureti, ... grs. vi.
Hydrargyri oxidi rubri, ... grs. vi.
Adipis benzoati, ... ad ʒi.
Creasoti, ... ♏ ij.
Misce.

Useful in all parasitic, papular, and squamous affections.

Unguentum Sulphuris Compositum.

℞ Sulphuris precipitati, ... ʒss.
Hydrargyri ammon. chloridi, . . . ʒss.
Acidi carbolici, ... gr. x.
Adipis recentis, ... ad ʒi.
Creasoti, ... ♏ ij.
Misce.

Useful in all parasitic affections, and in acne and chronic eczema.

Unguentum Sulphuris Hypochloritis.

℞ Sulphur. sublimati, ... ʒi.
Adipis recentis, ... ad ℥i.
Mix and add with quick manipulation.
Sulphuris chloridi (liquid), . . . ♏ viij.
Ol. amygdal. amari, ... gt. xx.
Misce.

Useful in acne, scabies, and psoriasis.

Unguentum Zinci Compositum.

℞ Zinci oxidi, ... 3 i.
Unguent. diachyli, B.S.H., ... 3 ij.
Glycerini, ... 3 ij.
Vaselini, ... ad ℥ ij.
Ol. amygdal. amari, ... grs. x.
Misce.

Useful in acute eczema, burns, and pityriasis.

Unguentum Acidi Borici.

℞ Acid. borici, pulv. levigati, ... 3 i.
Paraffini (135° 14), ... 3 v.
Vaselini, ... ℥ ss.
Misce.

Mix the paraffin and vaseline, and add the boracic acid.

Useful in chronic eczema, lichen and pruritus, burns and ulcers.

Unguentum Acidi Pyrogallici.

℞ Acidi pyrogallici, ... grs. lx.
Adipis benzoati, ... ad ℥ i.
Misce.

Useful in psoriasis and lichen.

Unguentum Chrysarobini.

℞ Chrysarobini, ... 3 i.
Adipis benzoati, ... 3 xxiv.
Misce.

Leave to dissolve as much as possible, and stir until cold.

Useful in ringworm, psoriasis, and lupus.

Unguentum Cocaini.

℞ Cocainæ, ... gr. xvi.
Adipis benzoati, ... ℥ i.

Useful in urticaria, pruritus, and other irritable symptoms.

Unguentum Cupri Oleatis.

℞ Cupri oleatis, ... ℥ i.
Petrolei cerati, ... ℥ iv.

Mix, melt, and stir until cold.

Especially useful in ringworm and indolent ulcers.

Unguentum Oleati Hydrargyri.

℞ Hydrargyri oxidi flav., ... 3 i.
Acid. oleic., ... 3 ix.
Adipis benzoati, ... ℥ i.
Misce.
Heat and stir frequently, gradually adding the acid.
Useful in parasitic diseases, ringworm, and specific eruptions.

Unguentum Iodoformi.

℞ Iodoformi, ... 3 i.
Adipis benzoati, ... ad ℥ i.
Melt the lard, and mix the iodoform until dissolved, then add Ol. eucalypti 3 ss.
Useful in foul ulcers and all specific ulcerations.

Unguentum Picis Liquidæ.

℞ Picis liquidæ, ... 3 i.
Cerati flavi, ... ad ℥ ij.
Mix well, and melt.
Useful in squamous and papular eruptions, such as psoriasis.

Unguentum Styracis.

℞ Storacis, ... ℥ i.
Sp. vin. rect., ... ℥ i.
Adipis benzoati, ... ℥ iij.
Misce.
Useful in scabies, where sulphur is not borne well.

Unguentum Sulphuris c. Hydrarg.

℞ Sulphuris sublimati, ... 3 ss.
Hydrargyri ammon. chlor., . . . gr. v.
Adipis benzoati, ... ad ℥ i.
Misce.
Useful in all parasitic diseases, especially scabies.

PILULÆ.

Pilula Arsenicalis.

℞ Acidi arseniosi, ... gr. $\frac{1}{20}$.
Pulveris piperis nigri, ... gr. i.
Extracti gentianæ, ... q. s.
Misce et ft. pil.
Useful in squamous and papular affections.

Pilula Arsenicalis Composita.

℞	Acidi arseniosi,	grs. v.
	Pulveris acaciæ,	ʒ ss.
	Pulveris cinnamomi compositi,	ʒ iij.
	Extracti jalapæ,	ʒ ij.
	Glycerini,	q. s.

Misce et divide in pilulas 100 æquales.
Pil. i. cont. $\frac{1}{20}$ acid. arsenios.
Useful in squamous and corneous affections.

Pilula Aperiens Alterativa.

℞	Hydrargyri chloridi,	ʒ ij.
	Pulveris jalapæ,	ʒ iij.
	Aloes socotrinæ,	ʒ iij.
	Ol. carui,	ʒ ss.
	Glycerini,	q. s.

Misce et divide in pilulas 50 æquales.
Useful as an ordinary alterative aperient.

Pilula Aperiens.

℞	Pilulæ colocynthidis compositæ,	grs. ij.
	Extracti taraxaci,	grs. ij.

Misce et ft. pil.
Useful as an ordinary aperient.

Pilula Hydrargyri c. Creta et Pulv. Doveri.

℞	Hydrargyri c. creta,	grs. ij.
	Pulveris Doveri,	grs. ij.

Misce et ft. pil.
A useful pill in the primary stages of syphilis, and as an alterative.

Pilula Hydrargyri c. Ferro.

℞	Pilulæ hydrargyri,	grs. ij.
	Ferri sulphatis,	grs. ij.
	Extracti opii,	gr. ¼.

Misce et ft. pil.
Useful in secondary syphilitic eruptions of the skin.

Pilula Hydrargyri Iodidi Rubri.

℞ Hydrargyri iodidi rubri, ... gr. $\frac{1}{30}$ ad $\frac{1}{8}$.
Extracti gentianæ, ... grs. ij.
Pulveris opii, ... gr. $\frac{1}{4}$.
Misce.
Useful in the treatment of tertiary syphilis.

Pilula Hydrargyri Tannat.

℞ Hydrargyri tannat., ... gr. i.
Extracti gentianæ, ... grs. ij.
Misce.
Useful in syphilis as producing little disturbance of the gastric and intestinal mucous membranes.

General Directions.

Directions.—Remove all flannel or other irritating substances from next the skin; wash with warm water. Avoid using soap of any kind to the parts affected: use instead, fine bran, oatmeal, yolk of egg, linseed meal, arrow-root, or starch with warm water, or warm milk and water. Yolk of eggs and warm water to be used to the scalp.

Dry the skin with soft linen, and smear gently with the ointments, or dress the wounds with the same, spread thinly upon lint or linen, and bathe the parts affected with the lotions, but not more frequently than directed by the medical officer.

Rinse the mouth with water, and brush the teeth after taking the medicines, if possible.

Rules of Diet.

Avoid shell fish, salt meats, soups, sweets, acids, fruits, pastry, raw vegetables, salt fish, cheese, dried fruits, ices, curries, pickles, much sugar, hot condiments, and other indigestible foods.

No malt liquors, wine, or spirits to be taken without the sanction of the medical officer.

Meals.

Breakfast.—Cocoatina, bread and milk, rice, milk, instead of tea or coffee, with or without eggs, bread and butter and boiled bacon.

Dinner.—A little plain roast or boiled fresh meat, fish or poultry plainly cooked, rice, egg and flour, or any light, plain puddings, potatoes, and a few vegetables.

Supper.—Milk and water, cocoatina, gruel, or other farinaceous food, with bread and butter.

Drinks.—Mineral waters, barley water, toast and water, and light French or German wines, if sanctioned by the medical officer.

CHAPTER II.

CLASSIFICATION OF DISEASES.

THE classification I propose to put before you is as follows:

1. Cachectic eruptions.
2. Chromatic (color) eruptions.
3. Erythematous eruptions.
4. Hemorrhagic "
5. Medicinal "
6. Neuralgic "
7. New growths (neoplasmata).
8. Papular eruptions.
9. Parasitic { 1. Animal. 2. Vegetable.
10. Pustular eruptions.
11. Sebaceous eruptions.
12. Simulated "
13. Squamous "
14. Structural "
15. Syphilitic "
16. Tubercular "
17. Ulcerous "
18. Vesicular "
19. Diseases of the hair and nails.
20. Diseases of the sweat glands.

In preparing this classification, I have taken suggestions of Willan, Startin, Wilson, Kaposi, Duhring, and others, the main principles of which have already stood the test of some half-century's work, clinical and microscopical.

CLASS I.—*Cachectic Eruptions.*—Showing some general constitutional cachexy or idiosyncrasy, congenital, supervening, or acquired: 1. Cancerous affections of the skin, melanotic, carcinoma, epithelioma. 2. Cachectic ecthyma. 3. Elephantiasis græcorum; or true leprosy. 4. Frambœsia or yaws. 5. Scorbutic eruptions or scurvy. 6. Strumous eruptions, scrofuloderma. 7. Lupus, L. erythematosus, and L. vulgaris. 8. Rodent ulcer. 9. Sarcoma.

CLASS II.—*Chromatic or Pigmentary Eruptions.*—Showing changes of color for the most part symptomatic of some constitutional vice or cachexy:—1. Achromia or spotted skin. 2. Albinismus or white skin. 3. Canities. 4. Cancer stain.

5. Chloasma, discolored skin. 6. Crimson stain. 7. Cyanoderma, blue skin. 8. Ephelis, sun-brown. 9. Lentigo, freckles. 10. Leucoderma, patches of white skin. 11. Lepra alphoides. 12. Macula hepatica. 13. Melanoderma, black skin. 14. Morbus Addisonii. 15. Nitrate of silver stain. 16. Pigmentary moles. 17. Syphilis stain. 18. Xanthochoia icterus, yellow stain. 19. Pityriasis nigricans. 20. Nævus pigmentosus.

Class III.—*Erythematous.*—Showing heat, redness, tension, swelling, sometimes lymphoid inflammation, superficial, circumscribed, or diffused:—1. Acrodynia or epidemic erythema. 2. Anthrax or carbuncle. 3. Bucnemia tropica. 4. Erythema. 5. Erysipelas. 6. Furunculus or boil. 7. Hyperæmia follicularis. 8. Intertrigo. 9. Chilblain. 10. Frost bite. 11. Pellagra or Italian leprosy. 12. Urticaria or nettlerash. 13. Burns and scalds. 14. Insect stings.

Class III*a*.—*Exanthemata.*—1. Roseola, rubeola, scarlatina.

Class IV.—*Hemorrhagic.*—Hemorrhagic affections showing patches of hemorrhage varying in size, under the epidermis, local or general:—1. Purpura, simplex, rheumatica or peliosis rheumatica, hemorrhagica. 2. Hæmatidrosis or bloody sweat.

Class V.—*Medicinal Rashes.*—Showing eruptions by the administration of certain drugs:—1. Arsenic rash. 2. Arnica rash. 3. Bromide rash. 4. Belladonna rash. 5. Copaiba rash. 6. Croton-oil rash. 7. Hyoscyamus rash. 8. Iodine rash. 9. Iodide of potassium rash. 10. Iodoform rash. 11. Iodide-of-starch rash. 12. Quinine rash. 13. Sulphur rash. 14. Chrysophanic-acid rash. 15. Tar rash. 16. Rashes produced by dyes.

Class VI.—*Neuralgic.*—Showing neuralgia with increased, vitiated, or diminished cutaneous sensibility, with or without eruptions or ulcerations:—1. Alopecia areata or circumscripta. 2. Hysterical anæsthesia and hyperæsthesia. 3. Neuralgic erythema. 4. Prurigo senilis. 5. Pruritus. 6. Herpes zoster. 7. Neurotic excoriation.

Class VII.—*New Growths. Neoplasmata.*—Showing growths upon the surface of the skin, in the blood-vessels, connective tissue, lymphatics and nerves:—I. *Connective tissue:* i. Molluscum fibrosum; ii. Keloid; iii. Xanthelasma. II. *Blood-vessels:* i. Angioma; ii. Nævus vasculosus. III. *Lym-*

phatics: i. Lymphangioma; ii. Lymphadenoma. IV. *Nerves:* Neuroma. V. *Granulation tissue:* Rhinoscleroma.

CLASS VIII.—*Papular.*—Showing red points, or papules more or less mixed, disseminated or confluent. 1. Acne, simplex, punctata. 2. Hyperæmia cutis, and cutis anserina. 3. Lichen and its varieties. 4. Pityriasis pilaris. 5. Strophulus.

CLASS IX.—*Parasitic.*—Showing animal and vegetable life, visible and microscopic, giving rise to various cutaneous manifestations, mostly contagious.

Animal.—I. *Dermatozoa:* Parasites which dwell in the substance of the skin. 1. Guinea-worm disease. 2. Harvest insect rash. 3. Scabies. II. *Ectozoa:* Parasites that live on the surface of the skin. 1. *Morbus pedicularis:* Pediculus capitis, or head louse, P. corporis, or body louse, P. pubis, or crab louse. 2. Pulex irritans, or flea. 3. Cimex lectularius, or bug. 4. Pulex pipiens, or gnat. 5. Œstrus, or bot. 6. Pulex penetrans, or sand flea.

Vegetable.—1. Aphthophyta, or thrush. 2. Alopecia parasitica. 3. Phytiform disease (or ringworm) of scalp. Phytiform disease (or ringworm) of body. 4. Phytiform disease of scalp, called favus. 5. Phytiform disease of beard, called sycosis. 6. Phytiform disease of body, called pityriasis versicolor. 7. Tropical ringworm. 8. Phytiform disease of eyelids, called tinea tarsi. 9. *Mycosis;* ears, anus, vagina, and nipples. 10. *Mycoderma,* or fungus foot of India. 11. *Onychophytosis,* phytiform disease of the nails.

CLASS X.—*Pustular.*—Showing pustules, blebs, or blisters containing matter or pus, sometimes bloody, with or without an inflamed cutaneous surface or base, isolated or confluent. 1. Ecthyma. 2. Impetigo. 3. Impetiginous eczema. 4. Rupia. 5. Sycosis. 6. Variola. 7. Varicella. 8. Vaccinia.

CLASS XI.—*Sebaceous.*—Showing an unctuous secretion from the sebaceous follicles, exuding, or expressed by pressure, adherent or non-adherent to the skin. Due to increased secretion or faulty excretion of sebaceous matter. 1. Acne sebacea: Comedones albidi, seborrhœa. 2. Asteodes. 3. Chromasteodes. 4. Hordeolum, or stye. 5. Molluscum contagiosum or acne molluscum. 6. Sebaceous tumors. 7. Xeroderma, ichthyosis.

CLASS XII.—*Simulated.*—Instances in which various eruptions have been self-inflicted by using some irritating sub-

stance on the skin, or by rubbing or scratching the skin. 1. Alopecia. 2. Discolorations. 3. Eczema. 4. Erythema. 5. Pemphigus. 6. Ulcerations.

CLASS XIII.—*Squamous.*—Showing scales, loose or attached to the skin, with or without an inflamed base, often in form more or less circinate, accompanied with irritation generally. 1. Eczema siccum. 2. Ichthyosis. 3. Pityriasis and its varieties. 4. Psoriasis or Lepra. 5. Dermatitis exfoliativa.

CLASS XIV.—*Structural.*—Showing changes, or new growths in the skin. 1. Cicatrices. 2. Corns or clavi. 3. Fibroma. 4. Keloid. 5. Morphœa. 6. Nævi. 7. Moles. 8. Scleroderma. 9. Verrucæ or warts—i. Vulgares; ii. Seniles; iii. Acuminatæ. 10. Tylosis, callosities. 11. Horns. 12. Nævus pilosus. 13. Elephantiasis arabum.

CLASS XV.—*Syphilitic.*—Showing eruptions due to a specific poison either hereditary or acquired. 1. Syphilitic acne. 2. Syphilitic alopecia. 3. Syphilitic ecthyma. 4. Syphilitic herpes. 5. Syphilitic lichen. 6. Syphilitic macula. 7. Syphilitic onychia. 8. Syphilitic pemphigus. 9. Syphilitic psoriasis, palmaris and plantaris. 10. Syphilitic roseola. 11. Syphilitic squamous eruptions. 12. Syphilitic tubercular eruptions. 13. Syphilitic ulceration and gummata. 14. Syphilitic vesicular eruptions.

CLASS XVI.—*Tubercular.*—Showing red, raised, and inflamed tubercules and swellings, sometimes single, and sometimes confluent, occasionally suppurating or ulcerating. 1. Lupus cum hypertrophia (see cachectic eruptions). 2. Molluscum (see new growths). 3. Sycosis indurata (see pustular eruptions). 4. Tubercular syphilis (see syphilitic eruptions). 5. Tubercular scrofula (see cachectic eruptions). 6. Urticaria tuberosa (see erythematous eruptions).

CLASS XVII.—*Ulcerous.*—Showing a solution of continuity with or without sloughing and an inflamed base, often attended with varix on the lower extremities (see erythematous). 1. Anthrax ulcer. 2. Erythematous ulcer. 3. Ecthymatous ulcer. 4. Impetiginous ulcer. 5. Lupoid ulcer. 6. Parasitic ulcer. 7. Rodent ulcer. 8. Syphilitic ulcer. 9. Scrofulous ulcer. 10. Rupial ulcer (see cachectic eruptions). 11. Varicose ulcer. 12. Simple ulcer. 13. Fissures.

CLASS XVIII.—*Vesicular.*—Showing vesicles, blisters, blebs or bullæ, containing a sero-purulent or serous fluid, with

lymphoid incrustation, and a phlegmonous base, sometimes causing excoriations. 1. Ampullæ. 2. Eczema. 3. Herpes. 4. Miliaria. 5. Pemphigus, vulgaris, foliacius, cheiro-phompholyx. 6. Sudamina. 7. Scalds. 8. Hydroa, and its varieties.

CLASS XIX.—*Diseases of the Hair and Nails.*—Showing certain conditions of the hair and nails in an unhealthy state, baldness, roughness, ringed hair.

Hair.—1. Alopecia. 2. Ringworm, or phytosis. 3. Hirsuties. 4. Nævus pilosis. 5. Trichorrhexis nodosa. 6. Plica polonica. 7. Parasitic sycosis of beard (see Parasitic Eruptions). 8. Parasitic affection of eyelids (see Parasitic Eruptions). 9. Splitting of the hair and abnormalities.

Nails.—1. Onychia.

CLASS XX.—*Diseases of the Sweat Glands.*—Showing increased activity, and sometimes inflammation of the sweat glands, with or without pigment. I. *Quantity.*—1. Hyperidrosis. 2. Anidrosis. II. *Quality.*—Bromidrosis, chromidrosis. III. *Retention.*—Dysidrosis, sudamina.

In this system of classification I have followed as nearly as possible those prominent symptoms in each class and variety as we generally see them before us. It will be seen that we divide them into twenty classes, as few as is deemed necessary in so vast a subject, and these again into their varieties or subdivisions.

I have made separate classes of the syphilitic, parasitic, diseases of the hair, and diseases of the sweat glands, as I considered them severally of sufficient importance to do so.

The neuralgic class or trophic disturbance of nerve influence, is important, for as yet we do not know how many eruptions are due to nerve disturbances. We are probably coming to a time when we shall include many more eruptions in this class than are here stated, such for instance as erythema, urticaria, prurigo, and some forms of eczema.

On the class of parasitic eruptions I have bestowed much care and study, and have enumerated all those known in this country. Why the term ringworm or tinea is still adhered to in the new nomenclature I cannot conceive, as both are misnomers, the vegetable parasitic growths being essentially phytiform in character. I have added a class also, simulated eruptions, as we sometimes have these cases brought under

our notice, and it is important at once to recognize them, and so prevent deception. Medicinal rashes also claim our attention occasionally and should be known, as they are often liable to puzzle and trouble the practitioner in his diagnosis and treatment of eruptions.

Diseases of the hair are now claiming much of our attention as dermatologists, trichorrhexis nodosa, and other newly noticed diseases of the hair.

Therapeutic Index.

Acne.—*Internal.* Sulphurated lime, iron and acid mixtures, ergotin, sulphur, citrate of quinine and iron, and the hypophosphites. *Local.* Calamine and sulphur lotion, ointments of chrysarobin, ichthyol. Sulph. hypochlor., thymol, hydrarg. amm. chlr., boracic acid.

Alopecia. — *Internal.* Pilocarpine, strychnia. *Local.* Liquid ammonia, cantharides, iodine, petroleum spirit, pilocarpine nitrate solution, blistering fluid.

Bromidrosis } Tannic acid. Oxide of zinc, lead plaster,
Osmidrosis } Condy's fluid.

Burns and Scalds.—*Local.* Ointments of calamin, boracic acid, cocaine, iodoform, thymol and oleate of zinc, linseed oil and lime water.

Cancer.—*Internal.* Arsenic, resorcin, sulphurated lime, Chian turpentine. *Local.* Caustic zinc chloride fort., caustic acid nitrate of mercury, caustic sodium ethylate, caustic chromic acid, idoform and resorcin ointments, oleate of morphine, and Vienna paste.

Carbuncles and Boils.—*Internal.* Tonics, iron and acid mixtures, sulphurated lime, arsenic, hypophosphites, sulphur. *Local.* Boracic acid, nitrate of silver, glycerin of belladonna, collodium, incision.

Chilblains.—*Internal.* Iron tonics. *Local.* Ointments of boracic acid, carbolic acid, cajeput oil, eucalyptus oil, tincture of iodine, glycerin of subacetate of lead, anodyne amyl colloid (Ferris).

Corns and Warts.—*Local.* Acetic acid, carbolic acid, collodium cullosum, chromic acid, acid nitrate of mercury, sodium ethylate.

CHANCRES SOFT.—*Local.* Black wash, iodoform, resorcin, lead lotion, lotion of the red and yellow oxides of mercury.

CHANCERS, HARD.—See Syphilis.

CHLOASMA AND TINEA VERSICOLOR.—*Local.* Ointments of hyd. am. chlr., chrysophanic acid, sulphurous acid, lotion of hypophosphite of soda, glycerin of borax.

COMEDONES.—See Acne.

CHAPPED SKIN.—*Local.* Boracic acid ointment, collodium, glycerin of lead, petroleum cerate.

CONGENITAL SYPHILIS.—See Syphilis.

CONDYLOMATA.—*Internal.* Mercury, iodide of potassium. *Local.* Iodoform, acid nitrate of mercury.

DANDRUFF.—See Pityriasis capitis.

DERMATITIS.—*Internal.* Alkaline aperients, acid and iron tonics. *Local.* Ointment of boracic acid and zinc, oxide of zinc powders.

ECTHYMA.—*Internal.* Tonics, cod-liver oil, and iron, hypophosphites. *Local.* Boracic acid ointment, petroleum cerate, iodoform, iodide of starch.

ECZEMA.—Alkaline and iron mixtures, arsenic, sulphur. *Local.* Lotions of zinc and boric acid, calamin lotion, zinc ointment, boric acid ointment, oleate of zinc and bismuth, lead ointment, glycerin of subacetate of lead, ointment of diachylum, liq. carbonis detergens, zinc and bismuth powders.

ELEPHANTIASIS ARABUM.—*Local.* Cor pression by elastic bandage.

EPITHELIOMA.—*Local.* Destruction by the knife, or by caustics.

ERYTHEMA.—*Internal.* Mixtures of magnesia, iron and acid. *Local.* Glycerin of starch, lead lotion and ointment, belladonna ointment.

ERYSIPELAS.—*Internal.* Perchloride of iron, iron and acid mixture, belladonna, ergot, digitalis. *Local.* Perchloride of iron liquor, boracic acid lotion, calamin lotion, collodium, iodine pigment.

FAVUS.—See Parasitic affections.

GROCER'S ITCH.—See Eczema.

HERPES ZOSTER. HERPES OR SHINGLES.—*Internal.* Iron and acid mixture, magnesia mixture, quinine preparations, saline aperients. *Local.* Collodium, oxide of zinc and starch powder, anodyne amyl colloid, ointment of oleate of zinc.

ICHTHYOSIS.—*Internal.* Iron and arsenic tonics. *Local.* Rubbing in oil and glycerin, vapor and alkaline bath.

IMPETIGO.—*Internal.* Arsenic and iron mixtures, quinine, phosphorus. *Local.* Ointments of hyd. am. chlr., sulphur, oleate of zinc. Iodoform.

INTERTRIGO.—See Eczema.

KELOID.—Removal by caustic or the knife.

LENTIGO OR FRECKLES.—*Local.* Bichloride of mercury lotion. Laurel water.

LEPRA.—Old name for psoriasis.

LEPRA GRÆCORUM.—True leprosy.—*Internal.* Chaulmoogra oil, tonics, gynocardic acid, anacardium, gurjun balsam. *Local.* Gynocardic acid, chaulmoogra oil, gurjun oil.

LEUCODERMA.—*Internal.* Iron and arsenic tonics, digitalis, phosphorus. *Local.* Iodine.

LICHEN PLANUS.—*Internal.* Arsenic and mercury, cod-liver oil, mineral acids, iron tonics. *Local.* Alkaline and borax baths and applications. Ointment of ammonio-chloride of mercury, tarry applications.

LUPUS.—*Internal.* Arsenic and iron tonics, resorcin. *Local.* Destruction by caustic, acid nitrate of mercury, ethylate of sodium, iodoform, resorcin, nitrate of silver, ointment of gynocardic acid. Arsenic. fort., potassa fusa. Erosion, scarification.

MILIUM.—See Acne comedones.

MOLLUSCUM CONTAGIOSUM.—*Internal.* Iron and cod-liver oil. *Local.* Applications of caustic, evacuation of contents of the growth.

MORPHŒA.—*Internal.* Tonics, arsenic and iron, phosphorus. *Local.* Iodine and mild stimulants, ointment of hyd. am. chlr.

NÆVUS.—*Local.* Scarification, application of caustics, acid nitrate of mercury, ethylate of sodium, galvano-cautery, electrolysis.

ONYCHOMYCOSIS.—*Local.* Salicylic acid, boracic acid, weak mercurial ointments.

PARASITES, VEGETABLE.—*Local.* Boracic acid, carbolic acid, chrysophanic acid, sulphuric acid, oleate of copper and mercury, thymol ointments.

PEDICULI.—*Local.* Oleate of mercury, sulphur, ointments of hyd. am. chlr., naphthol, sulphur baths, sulphuretted lime

lotion, paraffin oil, carbolic acid ointment. Clothes should be exposed to temperature of 200° for disinfection.

PEMPHIGUS.—*Internal.* Arsenic, iron and quinine, cod-liver oil. *Local.* Calamin and zinc powder, boracic acid, ointment of nitric oxide of mercury.

PITYRIASIS.—*Internal.* Iron and arsenic tonics. *Local.* Boracic acid, ointment of subacetate of lead, ointment of nitric oxide of mercury, glycerin of borax.

PRURIGO.—*Internal.* Arsenic, iron and mineral acids and quinine. *Local.* Boracic acid, carbolic acid lotions. Alkaline baths. Cocaine ointment, mercurial ointments, glycerin of starch and soothing applications.

PRURITUS.—*Ani, vulvæ. Internal.* Tonics, iron and quinine, arsenic. *Local.* Boracic acid lotion, ointments of cocaine, salicylic acid, chloroform lotion, gall and opium ointment, alkaline lotion, tannin lotion and vinegar.

PSORIASIS.—*Internal.* Arsenic, mercurial preparation, cod-liver oil, phosphorus, iron. *Local.* Mercurial and tar preparations, chrysophanic acid, pyrogallic acid, ichthyol, oil of tar, soft soap, ointments of naphthol.

PURPURA.—*Internal.* Mineral and vegetable acids, gallic acid, ergot, phosphorus, quinine, iron, oil of turpentine.

RINGWORM.—See Parasitic affections.

RODENT ULCERS.—See Epithelioma.

ROSEOLA.—*Internal.* Cooling alkaline medicine. *Local.* Zinc and calamine lotions.

RUPIA.—See Syphilodermata.

SCABIES OR ITCH.—*Local.* Sulphurated lime, storax ointment, sulphur, ointment of soft soap, sulphur vapor bath, carbolic and mercurial ointments.

SCLERODERMA.—*Internal.* Cod-liver oil, tonics, arsenic. *Local.* Glycerin and oil inunctions.

SEBORRHŒA.—*Internal.* Iron and arsenic. *Local.* Resorcin, tar, mercury, and boracic ointments.

SHINGLES.—See Herpes zoster.

SYPHILODERMATA.—*Internal.* Tonics, mercury, iodide of potassium, sarsaparilla. *Local.* Mercury and iodoform ointments and fumigations.

TINEA.—*Tonsurans, Sycosis, Favus, Versicolor.* See Parasites, vegetable.

ULCERS.—*Internal.* Tonics, iron and arsenic. *Local.*

Boracic and lead lotions; mercurial, boracic and zinc ointments.

URTICARIA or Nettle Rash.—*Internal.* Alkaline medicines, tincture of rhus toxicodendron. *Local.* Soothing lotions and ointment, alkaline baths, and vinegar.

WARTS.—*Local.* Destroy with caustics.

THE

NASAL NEUROSES.

BY

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THE NASAL NEUROSES.

CHAPTER I.

THE PHYSIOLOGICAL REFLEXES.

In discussing the subject of the symptoms or diseases arising from a reflex irritation originating in the nose, we come into a region where it is very difficult to steer clear of the innumerable theories and fancies that have troubled the minds of rhinologists during the last few years since Daly, Roe, etc., of America, and Hack, of Freiburg, revived a controversy started by Voltolini in 1871. The clinical observations recorded by these gentlemen are open to the most respectful consideration; for many similar experiences must have occurred to any one having opportunity of encountering them. Hack, indeed, surpassed all other observers in the multitude of affections which he traced to disease of the nasal mucous membrane, though few have indorsed his theoretical pathology with their clinical observations. In the following remarks it will be attempted to avoid, as far as possible, irrelevant theories, inquiring merely into such physiological bearings as may prove of any assistance, examining closely all clinical facts, and basing upon these any deductions that it may be necessary to draw.

Certain physiological reflex actions are commonly known to occur as the immediate result of irritation of the healthy nasal mucous membrane. These are, briefly speaking, sneezing, cough, and lachrymation, deglutition being only exceptionally observed. To a certain extent the regions to which such phenomena belong are correlated—that is to say, some forms of irritation of the conjunctiva, such as bright sunlight, may produce sneezing, or a foreign body in the larynx, besides

cough, may also induce a flow of tears; while a bitter placed well on the back of the tongue, in some individuals, may produce sneezing and lachrymation. Such points vary considerably in different subjects—a point of some importance in considering the remarkable symptoms of the so-called hay fever. Into the precise course of the reflex action in these different cases it is unnecessary to inquire; yet it may prove of some assistance to investigate the purpose, if any, served by these physiological reflexes, as well as some of their methods of excitation.

In a case where the physiological reflexes are apparently in a normal condition of intensity, it would appear that irritation of the anterior parts of the nasal fossæ by any mechanical means may produce the reflexes of sneezing, lachrymation, and rhinorrhœa. Of this neighborhood the membrane lining the anterior wall of the fossæ above the vestibule is generally the most sensitive. Only slightly less sensitive is the corresponding portion of the septum; while distinctly less provocative of these reflex phenomena are the anterior extremities of the middle and inferior turbinated bodies. Nevertheless the latter, together with any portion of the interior of the nose, are of course fully competent to produce the sneezing, etc., if sufficiently irritated. Passing backward the septum still appears to be the most sensitive region; but as the posterior parts are approached the character of the reflex action changes. As the tendency to sneeze becomes less, that to cough takes its place. This is especially seen when the posterior ends of the inferior turbinated and the region of the Eustachian tubes are irritated. The cough thus produced is hard, hollow, and, as the patient says, irritating, the sensation being referred to the neighborhood of the larynx and trachea. Occasionally, when there is prolonged irritation in this region, the act of deglutition is also excited in addition to the cough. But I have never seen any other evidences of reflex action than those enumerated. Consequently the question naturally suggests itself, Why, in conditions of disease, should we find reflex effects produced which cannot be provoked by physiological means? Are we to assume that paths along which reflex actions take their course exist in pathological states, though unknown in conditions of health? This is a question which, in the present state of our knowledge, it is impossible to an-

swer. But clinical facts, so far as I have observed them, appear distinctly to point to the fact that those affections, which are obviously due to reflex action instigated in the nasal mucous membrane, merely proclaim the fact that the nerve-endings are abnormally irritable, and thus too prone to induce the physiological consequences of their stimulation: in other words, we find such symptoms as sneezing, lachrymation, coughing, and perhaps deglutition, though physiological in themselves, yet excited by conditions which must be considered pathological; while it is probable, judging from clinical observation, that no amount of pathological irritation will give rise to any symptoms beyond these, except perhaps in some rare cases of epilepsy where pathological conditions of the nerve centres must be presumed to exist.

It may be claimed that the reflex actions, said to be produced by pathological irritation of the mucous membrane, may be, after all, but exceptional expression of physiological fact. But the point I would maintain is that, whereas physiological reflexes are for the most part productive of some utility, such symptoms as those claimed by Hack, etc., to arise from nasal irritation, are obviously harmful to the economy. Again, it may be doubted whether the physiological reflexes can be considered as in any way beneficial. Sneezing, it may be argued, is not of any use in driving the irritating particles from the nose, seeing that it consists essentially in a closing of the palate during spasmodic expiration, and thus prevents the current of air from passing through the nose. But we probably find a correct explanation of the phenomenon in the following considerations: On the entrance of an irritating particle into the nose, the primary object of the reflex phenomenon is to increase the flow of mucus, not only for the sake of interposing some non-irritating substance between the sensitive membrane and the foreign particle, but even more for the purpose of washing it away. This increased flow is produced by a double mechanism: in the first place, there is the supply of more blood and the stimulation of the secreting cells through nerve influence; and in the second, there is increased intra-vascular pressure from overfilling of the venous sinuses. Now this pressure in the venous sinuses must be enormously increased by the convulsive expiratory act comprised in sneezing. This latter consists in a violent contrac-

tion of the diaphragm, etc., together with a closing of the glottis, of the post-nasal space by contraction of the velum and superior constrictors, and of the buccal orifice by the approximation of the tongue firmly to the teeth and hard palate; in fact, every possible movement is thrown into action to prevent the exit of air from the larynx, mouth, and nose. What is the immediate consequence of this? Increase of the intra-thoracic pressure, which necessarily increases intra-vascular tension, especially in the veins, and hence in the venous sinuses of the nose. The act of forcible expiration with all the outlets from the thorax closed, if voluntarily induced, *i.e.*, without the preliminary irritation in the nose, is scarcely operative in producing the effect described; and it is probably only when the nerve stimulation is excited at the same time, and the gland cells are set working, that this increase in the venous pressure is of some additional assistance.

On the entrance of a foreign body into the nose and its passage to the posterior regions we have, as has been remarked, cough substituted for the sneezing. The phenomenon probably results from that area being approached, the stimulation of which results commonly in the expulsion of the offending body. The same theory would explain the attempts at deglutition.

We may now proceed to the diseases originating, actually or theoretically, in irritation of the mucous membrane in the nose. Foremost among them stands conspicuously the train of symptoms commonly called hay fever. With the majority of these there can be no manner of question as to their resulting from a reflex action originating in the nose. The sneezing, lachrymation, rhinorrhœa, and swelling of the inferior turbinated bodies are but physiological symptoms produced in individuals whose nerve terminations or nerve centres, from pathological or other reasons, are of a peculiarly sensitive nature. The further symptom, one almost as characteristic as those mentioned—viz., the asthma—cannot be said to be the result of intra-nasal irritation, so far as we are acquainted with the physiological consequences of such stimulation. And it is hardly obvious why, even on clinical grounds, it is necessary to conclude that the bronchial spasm, like the sneezing, etc., results from excitation of the nasal mucous membrane. For it must be remembered that the inspired current of air,

after its passage through the nose, encounters other regions perhaps as sensitive, but which, from the filtering properties of the nose, are less often exposed to the irritation of foreign substances. It appears perfectly permissible to assume that, as the nose resents the intrusion of irritating particles, so also will the bronchi, which in their turn will, by contracting their calibre, prevent the offending irritants from entering the lungs themselves. Hence sources of irritation which have escaped the filtering power of the nasal mucous membrane, will pass on to the lower respiratory passages, and there excite in a similar manner reflex actions that result in a contraction of the bronchial tubes. After the exciting cause has persisted for a variable interval, the swelling of the erectile tissue in the nose may become so intense as to occlude the nasal passages altogether; and in this case it is quite conceivable that, fewer particles being arrested in the higher regions of the respiratory tract, the bronchi will be more exposed to irritation, and the asthmatic symptoms will be more severe. Consequently the benefit accruing to such patients from having pathological conditions of the nose rectified, so far as there is any source of obstruction beyond that temporary one arising from the transitory turgescence of the erectile tissue, is perfectly intelligible. Yet two cases of hay fever occurring in my own practice, while throwing considerable light upon the value of the theory of nasal reflex as being the source of the asthmatic symptoms, point to the aggravation of the latter after nasal treatment. In one—that of Dr. L.—there had been intense suffering from all the worst symptoms of the affection for nine consecutive summers.

CASE I.—Hay Fever—Ecchondrosis of the Triangular Cartilage—Cure.

Dr. L., of Dunmow, Essex, consulted me on the 9th of April, 1888, complaining of the usual symptoms of hay fever. The affection consisted in a constant catarrh of the nose, which was greatly aggravated by the least exposure to air or dust at any period of the year. During the hay season the symptoms were always greatly aggravated, so that for the months of June and July he was compelled to visit his patients with his eyes protected with blue goggles, and his handkerchief always in his hand. He had consulted various specialists without ob-

taining any relief. On examining the nose, the only abnormality appeared to be a small ecchondrosis of the triangular cartilage with vascular tumefaction of the inferior turbinated bodies. The fossæ on both sides were below the average capacity, so that a very slight swelling of the inferior turbinated tissue would bring the adjacent surfaces of mucous membrane in contact. The middle turbinateds on both sides were perfectly healthy, and there had never been any purulent discharge. Consequently one scarcely perceives how the ethmoid bone could be considered gravely diseased. Dr. L. had been in the habit of using a 5-per-cent solution of cocaine; but the effect he found very transitory, and he was compelled to use it in increasing quantities and more frequently. Consequently he had arrived at the conclusion that it was doing him real harm, both locally and constitutionally. On the patient's first visit I cauterized the inferior turbinated bodies, and prescribed a spray containing a twelfth of a grain of chromic acid to the ounce of water, to be used for five minutes twice a day as soon as the hay season began its work of irritation.

On the 9th of June he wrote to me that he was having "no end of sneezing just now; it began about four days ago in style!" On the 3d of July he wrote further that he had patiently used the chromic acid without any benefit whatever. "The solution of cocaine," he says, "makes me quite comfortable for about an hour. I don't sneeze as much as I did or anything like it; but, what is more uncomfortable, my nose 'shuts up.' I have had asthma this year too, which I have not had before."

On the 12th of July, the severe symptoms having somewhat abated, I removed the ecchondrosis of the septum, and a fortnight later I further cauterized the inferior turbinated bodies. The result of the treatment was that the patient remained perfectly free from symptoms during the following months, except when he took an ordinary cold, which proved far less severe than on previous occasions, until the hay season of the following year, *i.e.*, of 1889. He still remained in almost perfect comfort; he discarded the blue glasses, he scarcely ever sneezed, and the handkerchief was very little in demand. But, as happened after the slight improvement in the symptoms during the previous summer, he suffered still more from

hay asthma after exposure to an atmosphere laden with grass pollen, although there were no nose-symptoms whatever. Until the improvement in the sneezing, etc., began, there had never been any asthma whatever. A single case such as this would appear to blow to the winds the theory that the asthma is the result of reflex irritation in the nose; on the contrary, it would rather appear that the nose being freer, the inspired air was less effectually filtered of its irritant particles, which, passing into the bronchi, caused a spasm of their muscles from direct irritation of their mucous surface. Fortunately, the patient experienced very little discomfort from the asthma, considering that it bore no comparison with the former troubles.

After having the abnormalities of the nose rectified, he passed through the following summer absolutely free from all the most distressing symptoms; but although the sneezing, lachrymation, and nasal obstruction had entirely ceased, the asthma was distinctly worse. This, however, he declared to be of quite a minor importance, as it never lasted many minutes. The other case was that of an American gentleman, also belonging to the medical profession, who had suffered the greater part of his life from all the usual symptoms of hay fever, and had had, to use his own expression, "his nose cleared out" on several occasions by the most distinguished specialists in America. He assured me that, although his purely nasal symptoms were considerably relieved, his asthma was emphatically worse. He, moreover, asserted that it was not an unusual experience with his countrymen, suffering from the malady, to find their asthmatic symptoms aggravated rather than improved by surgical treatment of the nose. I may remark that both the patients above referred to volunteered the information without being asked any question whatever on the subject. The explanation of such cases as these is probably to be found in the reflection, that while the treatment obviated the mutual friction of opposing surfaces consequent on slight swelling of the erectile tissue by making the nasal fossæ actually wider, it at the same time facilitated the access of the irritating particles to the tracheal and bronchial mucous membrane, and thus intensified the asthma.

But before dismissing the subject of the so-called nasal

asthma, it is only fair to state the views of some whose opinions, judging from the value of their work in general, one would hold entitled to a respectful consideration. Conspicuous among these is Dr. Bosworth, of New York. He informs us that out of eighty cases of all forms of asthma, including thirty-four of hay asthma, forty-six were cured and twenty-six improved. In every one of these cases there existed intra-nasal disease sufficiently well marked to justify, in the observer's opinion, the theory that it might exercise a decided effect in the production of the symptoms. He further argues that if the asthma was cured through the medium of the nose, we may conclude that the nose was the source of the trouble. He makes no suggestion of the possibility of the interference to nasal breathing being a direct cause of the immediate irritation of the bronchial mucous membrane.[1] And although no other statistics have been offered by other authorities, it must not be forgotten that many, whose opinions carry great weight, strongly insist upon the same point. Thus Trousseau has added the weight of his opinion, while Voltolini, as long ago as 1872,[2] published cases of asthma, where the cure of associated mucous polypi in the nose was followed by the cure of the former affection. To these must be added the convictions of such authorities as Sir Andrew Clark, Hack of Freiburg, M'Bride of Edinburgh, and Krause of Berlin;[3] with J. N. Mackenzie of Baltimore, Beverly Robinson of New York, and Sajous of Philadelphia.

Now, without disputing for a moment the observations of such men as these, it will not, I trust, be considered impertinent to suggest that they were made when the true importance of nasal respiration was not receiving the consideration to which it is entitled. For every case where asthmatic symptoms are relieved by restoring the passages through an obstructed nose may be accounted for on the hypothesis that, the nose being permitted to perform its functions, the bronchial mucous membrane is saved from the irritation to which it was formerly subjected. Moreover, in the face of the many cases that must have occurred to every one possessing a large opportunity of treating such, where no relief followed the rectification of the nasal disease, the reflex theory appears deficient; while in the instances I have quoted, where the asthmatic symptoms have been made actually worse, although the

concomitant nasal troubles have been cured, it falls completely to the ground. Yet there is no manner of doubt that a considerable number of asthmatical patients suffer from intra-nasal diseases, the majority of which are polypi. Of this association I have seen many instances myself; and probably it is the experience of many who see such patients and possess the necessary skill in examining the nose. Thus Schech, of Munich, declares that 64 per cent of his patients are thus affected; though Dr. de Havilland Hall tells me he believes the association to be very rare. Anyhow, it by no means follows that the nasal disease is the cause of the asthma. Just as many an attack of bronchitic asthma begins in a paroxysm of sneezing and other signs of rhinitis, so, I believe, do we find the two regions simultaneously involved in a chronic inflammatory process, which finds its expression in the production of polypus in the nose, and of bronchial catarrh and spasm lower in the respiratory tract. Finally, if the intra-nasal irritation, in cases of polypus, is the starting-point of the asthma, it is somewhat remarkable that, in any such case of long standing, the nasal mucous membrane should be so conspicuously deficient in common sensibility, as plainly exemplified during operative procedures.

For my own part, while I have met with nine cases where asthma was associated with sneezing and nose-disease, I have never found the bronchial symptoms materially relieved, although the general comfort was much improved, by the restoration of nasal breathing, and the cessation of the sneezing. (Last summer I effected a cure in a case of exaggerated hypertrophy of both inferior turbinateds of ten to twelve years' duration. During most of this period there had been complete obstruction. There had never been any symptoms of asthma; but six weeks after I had dismissed the patient as cured, he appeared suffering from severe bronchitic asthma! The nose was perfectly free of obstruction and catarrh. Probably this was a mere coincidence; but it is interesting in reference to the point under discussion.)

A few words will suffice to place before the reader the question of the possibility of epilepsy arising as the consequence of intra-nasal stimulation. One case of remarkable cure in a patient, the subject of post-nasal adenoid growths, sent to me for operation by Dr. John Davies, of Nottingham, is worthy of note.

CASE II.—Pseudo-Epilepsy — Post-Nasal Adenoids — Operation—Cure.

Master H., æt. ten years, a boy looking the picture of health, was sent to me by Dr. John Davis, of Nottingham, on account of some obstruction in the nose, which, he thought, might be responsible for the convulsions from which the patient had suffered for the previous four years. For the last eighteen months he had been under the care of Dr. Davis, to whom I am indebted for the following account of the seizures. The fits averaged two or three a week, though sometimes he would have only one a week for several weeks, or perhaps only one in two weeks. They always occurred in the night and during deep sleep. The fits were always more frequent in damp or wet weather, or after smoking, a vice over which his mother had no control. The malady had been diagnosed as epilepsy by three eminent medical men, though none of them had actually witnessed an attack. Dr. Davis further wrote as follows: "I was called out about thirty times by night to see him, and diagnosed not epilepsy but some obstruction at the back of the throat and nose. The seizures were of a suffocative convulsive character; the boy would get blue in the face—distinctly cyanotic. He would then throw his arms and legs about struggling for breath till awake, when all the symptoms would disappear. When in deep sleep, a very thin and narrow strip of tissue paper would not even quiver in the least degree when held in front of the left nostril, but would wave a little in front of the right. In superficial sleep the breath would make it waver in front of both nostrils, especially the right. During the last year the fits have been much more frequent."

On one occasion I had an opportunity of examining the patient during sleep, though I had not the good fortune to witness an actual seizure. The patient was snoring profoundly, and as the stertor became deeper and louder there arose a distinctly laryngeal stridor combined with the nasal sound. The face grew unmistakably dusky, though, previous to the point where his mother expected the convulsion to occur, he flung his arms up and awoke. Falling asleep again, the train of symptoms was repeated, although in a milder form. On examining the patient in the consulting room, it was at once apparent that the post-nasal space was ob-

structed. The patient presented the small pinched nose and open mouth characteristic of the affection. There was no anterior nasal stenosis or deafness. The hard palate was high and narrow to a conspicuous degree; while the soft palate, uvula, and posterior wall showed the pathognomonic appearance found in connection with post-nasal growths. No digital examination was made; but on the following day the patient was placed under an anæsthetic by Dr. Silk, and a large quantity of adenoid vegetations was removed. Some difficulty was experienced by the unwonted smallness of the post-nasal space.

The subsequent history is the important point in the case. For three months the boy had no snoring or convulsive attack. At the end of that time he caught a severe chill from becoming wet through, and afterward having his hair cut and shampooed at 9:30 P.M. A cigar added to the trouble, perhaps, and at midnight Dr. Davis was called out once more for one of the old attacks. On this occasion Dr. Davis remarked on the great improvement in the nasal breathing. Since then, up to the present time, there has been no appearance or threatening of an attack. And we may conclude that the patient owes his recovery to Dr. Davis' skilful recognition of the fact that the obstructed nasal respiration was the primary source of the convulsive seizures.

It is interesting to note in this connection that Mr. Howard Marsh has recorded two cases in which children died of convulsions after being operated upon for harelip. His explanation of the phenomenon is that the customary breathing space having been curtailed by the operation, the children became asphyxiated. Like cleft-palate, harelip is in all probability frequently, if not usually, associated with post-nasal adenoids.[4]

Sir Morell Mackenzie reports a most interesting case, seen in conjunction with Dr. Hughlings Jackson;[5] and Loewe[6] another; while Elsberg[7] stated that he had met with cases of chorea as well as epilepsy due to reflex-irritation within the nose. Among more recent cases may be mentioned two reported by Dr. F. S. Crossfield, of Connecticut, to the Section of Laryngology at the American Medical Association, 1889. These were both epilepsy, cured by the removal of nasal obstruction;[8] more lately six cases have been recorded by Schneider of Cologne.[9] J. N. Mackenzie says that the con-

nection between epilepsy and intra-nasal disease was known to the ancients.[10]

Such facts are beyond all dispute. Yet it is not quite clear that we are justified in attributing the symptoms to the irritation of the trigeminus, until further and more precise observations are forthcoming. My own case certainly suggests the possibility of actual interference in respiration being a possible source of the general convulsions, which began in deep obstructive snoring, passed into spasm of the glottis, and ended as soon as the patient was awakened. This view is corroborated by the fact that the patient had an attack on one occasion three months after the removal of the obstruction, when he took a severe cold, and his nasal breathing again became partially obstructed. The course of the symptoms was then precisely similar to that observed prior to the operation.

Of the further affections, supposed to be due to reflex action instigated in the nose, I have no experience; nor, I believe, have my colleagues at the Hospital for Diseases of the Throat. Such diseases are various aural symptoms, pharyngitis sicca, headache, vertigo, functional laryngeal pareses, enlarged thyroid, etc. Cases in which such affections are to be cured by intra-nasal surgery have not sought treatment at my hands.

CHAPTER II.

HAY FEVER AND PAROXYSMAL SNEEZING.

THE etiology of hay fever has been a matter of interest and discussion since the matter first appeared in the field of medical literature in 1819, when Bostock published an article on the subject in the "Medico-Chirurgical Transactions."[11] Since then it has been the excuse for innumerable theories as to its nature. Most of the communications of any value have been contributed by sufferers themselves, so that considerable weight has been attached to the most divergent hypotheses. Thus Helmholtz, holding that the "symptoms were produced by vibrios, which, although existing in the nasal fossæ and sinuses at other times, were excited to activity only by the summer heat,"[12] imagined he had found a specific for the affection in the injection of quinine into the nose, which appeared to give him the required relief. In 1873 Dr. Blackley,[13] of Manchester, published a most important and the first scientific work on the subject. He succeeded in conclusively proving that, at any rate in his own person, the pollen of certain graminaceæ was the exciting cause of the remarkable train of symptoms. He also remarked upon the striking idiosyncrasy which renders only the few susceptible to a source of irritation to which every one must be more or less exposed; but he was unacquainted with the local conditions which, to a certain extent, appear responsible for the idiosyncrasy. Four years later Dr. Beard,[14] of New York, published a brochure, the result of extensive inquiries in his own country, wonderfully prolific of the disease. In this publication he showed that a large percentage of the sufferers are of a neurotic temperament, and that constitutional treatment directed toward the amelioration of this condition is often of considerable value. In the following year Dr. Marsh,[15] also of New York, wrote with the object of showing that the pollen of the ragweed, flowering in the autumn, was the only source of the complaint. In

the year 1882 a theory was advanced by Dr. Daly,[16] of Pittsburg, which has been embraced with great ardor by almost every nose specialist both in America and in Europe. He claimed that the train of symptoms was due entirely to actual, objective intra-nasal disease, and quoted some cases in which he had cured the symptoms by correcting the nose disorders. His hypothesis that the nose itself is the seat of the trouble, has been adopted, though with some variations and qualifications of the theory, by most American authorities, such as Roe,[17] Sajous,[18] and H. Allen.[19] In this country the theory has been embraced with great enthusiasm by E. Woakes, M'Bride, and, in Vienna, by Hack. J. N. Mackenzie[20] holds that the coryza, as he considers it, is dependent upon some functional derangement of the nerve centres as its predisposing cause. In 1883 Sajous, of Philadelphia, brought prominently forward the theory that "hay fever was due to an idiosyncrasy on the part of certain individuals to become affected by certain emanations."[21] This fact, for such it must be considered by all who have approached the subject with unbiassed minds, was independently introduced a year later by Sir (then Dr.) Morell Mackenzie, who held to it so strongly that apparently he failed to see that local conditions had any bearing in the case.

My own experience, though somewhat limited in these cases, has led me to the following conclusions. The affection is perhaps best defined as paroxysmal sneezing. A title for a disease should keep clear of theory; and, as a designation, a constant symptom is preferable to a varying cause. By adopting such a name for the disease suggested, it is made to include the host of cases presenting all the subjective and objective symptoms of hay fever, but arising from causes other than those at work during the summer months. If we exclude such, it must be granted that the patients suffer from one disease in the summer and another in the winter, although the symptoms, subjective and objective, are the same in each case, the only difference being the exciting cause. As well might we argue that two attacks of gout were different diseases because one was excited by port and another by want of exercise. Therefore, including all these cases, we may assert that the affection is due to an abnormal sensitiveness of the nasal mucous membrane to sources of irritation differing

in different individuals. Thus, while in one person the symptoms are induced by the pollen of the grasses, and occur in the early summer months, in others the attacks are due to the ragweed (*Ambrosia artemisiæfolia*), or to roses or peaches; while in the same or in yet other cases, insusceptible of the influence emanating from such vegetables, we find a draught of air, common dust, or unrecognized sources of irritation, producing the symptoms. This abnormal sensitiveness again appears to be induced or aggravated in many cases by anatomical abnormalities in the nose, whether pathological or not; while, so far as these are amenable to treatment, the symptoms are susceptible of amelioration. In many cases, however, the nose is perfectly normal in appearance, and in such one can hardly look for improvement. In all, however, the mucous membrane appears to be abnormally sensitive to tactile stimulation. So much for a brief statement of fact.

The most striking predisposing cause is heredity. Thus Sajous tells us that of forty cases of hay fever "35 per cent have near relatives who present a clear history of hay fever or rose-cold, and that 42 per cent have asthmatic relatives."[22] Race presents an important factor; for the affection, so far as it arises from the irritation of pollen, appears to be confined to the Anglo-Saxon blood, whether in Europe or America. It is unknown in the tropics and is stated not to exist in Australia; but one of my patients was strongly affected on exposure to ripe rye grass on a farm near Melbourne.

CASE III.—Hay Fever, with Hypertrophy of Inferior Turbinated Body—Operation followed by Great Improvement.

Lord X. consulted me in November, 1888, complaining of hay fever, from which he had suffered for the greater part of his life. He had consulted specialists and physicians without ever obtaining more than the most temporary relief. His nose had been authoritatively stated to be perfectly free of any abnormality, although he could never breathe through it with any degree of comfort. The symptoms were all typical of pollen irritation during the hay season, although he suffered very much from catarrh during the whole year, and would take cold upon the slightest provocation; and this in spite of his being otherwise in perfect health. Perhaps he presented something of the neurotic temperament. On examining the

interior of the nose, I observed that the nasal fossæ were by no means contracted in their osseous parietes. The inferior turbinated on the right side was enormously enlarged from true hypertrophy, and from its posterior extremity a tumor the size of a small walnut was hanging, which pressed heavily upon the velum. The speech in consequence had a distinctly nasal quality. On the left side there was a very prominent ridge running from before backward, and encroaching upon the inferior turbinated body, which was somewhat enlarged from vascular tumefaction of its erectile tissue.

The treatment consisted, in the first place, in the removal of the post-nasal tumor. This was effected with the Mackenzie snare, guided through the anterior nares, and, with the assistance of the post-rhinal mirror, hitched over the growth. Twenty minutes altogether were occupied in the severance of the mass, which, before the final turn of the screw, was drawn into the nasal fossa so as to obviate all risk of its falling into the pharynx. With a pair of curved vulsellum forceps the tumor was seized from behind, and withdrawn through the post-nasal space and mouth. This operation alone gave the patient considerable relief, so far as the breathing was concerned. Not a drop of blood was lost, although the patient afterward proved that he was of a somewhat hemorrhagic temperament. A month later he complained that the sneezing began most distinctly in the left nasal fossa, and that it was now from this side that the flow of mucus proceeded. The inferior turbinated was consequently cauterized. This gave a certain amount of relief; but on 11th February I essayed to remove the projecting ridge. This, however, had to be abandoned on account of the very free hemorrhage, which gave some trouble for four or five days afterward. Consequently, the destruction of the ecchondrosis was completed by a series of applications of the galvano-cautery. Finally, some small excrescences were removed from the right inferior turbinated. This carried the treatment into the end of April, when it was considered, in view of the approaching hay season, to postpone further treatment till that was over. Last year (1889) the summer began fully three weeks earlier than usual, and with it the hay symptoms. In the case of Lord X., they persisted through the usual period, but were greatly mitigated in severity. Thus,

after exposure to the usual source of irritation, on regaining the shelter of the house the attack would subside in half an hour or so, instead of persisting the whole of that and perhaps the following day. Yet although the improvement was very striking, the patient was not cured of the susceptibility to the pollen. In the following autumn and winter, however, he expressed himself as being wonderfully comfortable and free from any catarrhal trouble.

The following extract from a letter lately received from my patient in response to a question I had asked, as to whether he had ever experienced the hay symptoms when in Australia, is of considerable interest in reference to the precise fact it contains of the patient's susceptibility to one special variety of pollen: "There was only one place where I had hay fever badly, and that was on a big grass farm in Victoria, not far from Melbourne. I was there just before Christmas, which is midsummer, as you know, in Australia. On this farm grew splendid crops of rye grass in flower, and which, shortly after I saw it, was ready for cutting. I was perfectly well till I reached the station near this farm. There was a strong wind blowing; and no sooner did we get into the open carriage that was to take us to our host's house than I was suddenly and severely smitten with grass fever of the most intense kind. I call it grass fever, as it is undoubtedly the pollen of the grass, and particularly rye grass, which affects me most. I was so ill that I was obliged to spend the whole day in the house until leaving the next morning, when I was again very bad till we got into the train and we had left that grass region. The same thing happens to me in England. I am a prisoner if the house is surrounded by uncut ripe grass. I again had a touch of the hay fever coming home through America in June; but nowhere else did I have it, and I am always perfectly free from it in the tropics, where this kind of grass does not grow. Flowers there do not seem to affect me."

As to sex, the general opinion appears to be that males are more susceptible than females. Thus Mackenzie, among his hay-fever patients, has met with thirty-eight of the former to twenty-three of the latter.[28] As indicated by Beard, the majority of the patients are of a neurotic temperament, although a large proportion are doubtless in perfect health. Of

this I have seen several conspicuous examples. This nervous temperament accounts also for the fact that the large proportion occurs among private patients as distinguished from the hospital class, although my experience does not tally with Mackenzie's, who states that he, in his large experience, has never met with a case among the latter. I can recall several cases in hospital patients where the symptoms have been aggravated during the hay season. Blackley and others have remarked that it is chiefly the town dweller who suffers. Doubtless, the rustic is comparatively exempt; but I can recall among my cases instances of robust country gentlemen highly susceptible to pollen irritation. A popular belief, which appears to have some slight foundation in fact, is that the thin aquiline nose is more liable than others to sneezing affections, and that this accounts for the greater prevalence of hay fever among the aristocracy.

Whatever the predisposing factors, whether local or constitutional, every attack of paroxysmal sneezing is dependent upon some definite exciting cause, the nature of which is guided by the idiosyncrasy of the individual patient. Dust of one sort or another is the immediate cause of the attack in most patients, although the nature of the particles composing it varies in each case. Thus in the form of the affection making its appearance in the early summer months, the pollen of certain graminaceæ is directly responsible for the irritation, as proved by Blackley in a series of most admirable experiments on himself, a considerable sufferer from the affection. In America there is a second variety appearing in the autumn, due to the pollen of the *Ambrosia artemisiæfolia,* which blossoms in the months of August and September. This plant in unknown in Europe, and Dr. Marsh claims that it is the sole cause of the affection in the United States. But in this he is obviously in error, seeing that the early summer has its victims as in this country. In America also they have similar symptoms arising from roses, and to these is given the popular name of rose-cold. Some patients are affected by only one or more of these various sources of irritation, while others may be irritated by every one. Not infrequently a patient is liable to be equally affected by any form of dust, all the year round, although the symptoms are only fully developed during the summer months; another will be attacked only by certain

forms of dust, as, for instance, when dusting furniture, or by the emanations from a feather-bed. Or again, a patient may develop an ordinary chronic rhinitis with periodical paroxysmal sneezing, and after its persistence for a few years, for the first time in his life, he may become susceptible to the influence of certain forms of pollen. So that, in the face of such facts, one hardly perceives the justification in reserving the term "hay fever" for those cases arising from one source of irritation rather than another. Were we to consent to this, we must have innumerable designations for the same train of symptoms according to their various exciting causes. The fact is, that we cannot consider hay fever as an affection *sui generis*, but merely as a train of symptoms, due, in the first place, to a peculiar idiosyncrasy on the part of the individual, which may be actually induced or merely enhanced by certain departures from the normal condition of the nose, pathological or otherwise, which interfere with the easy performance of the functions of respiration. This statement appears to me to be the best possible definition of the term "hay fever" consistent with the various facts and independent of theory insusceptible of experimental verification. It forms no argument against such a definition to assert that the so-called typical hay-fever patient often presents no departure from the normal in the objective appearances of the interior of the nose. For the most hyperæsthetic nasal mucous membrane I have ever witnessed was sensitive to every source of irritation except pollen, and presented not the slightest objective fault. Yet there is no question that the majority of all patients subject to paroxysmal sneezing, etc., from whatever excitant arising, do present aberrations from a condition of perfect health; and the treatment of such conditions indubitably ameliorates or removes the symptoms in the majority of cases.

In describing the symptoms we may divide them into two classes, between which, however, there is no sharp line of demarcation. The first comprises those cases where the disorder is due to the irritation of pollen, etc., and the second those which suffer independently of the season of the year with its attendant vegetation. With the first class the premonitory symptoms usually make their appearance during the first week or ten days in June. In cold seasons the appearance is more or less delayed, while, in the reverse conditions, their

onset may be considerably earlier; thus, for instance, in the summer of 1889, the patients began to suffer a full three weeks earlier than their wont. The premonitory warnings vary considerably with the individual. A common one is an itching, smarting, or burning at the inner canthus of one or both eyes. Others will complain of similar discomfort in the throat or roof of the mouth. Sometimes the irritation is confined to the alæ, while with others, again, the earliest symptom is a curious coldness of the tip of the nose. These or other incipient symptoms persist for a period, varying from a few hours to two or three days, or even weeks, before the sneezing supervenes. But usually the attack asserts itself with great suddenness and in its full force at the outset. The irritation in the nose and conjunctiva, and even in the pharynx, begins almost simultaneously. The inferior turbinated swells with great rapidity until the nasal passages are completely blocked; and, certainly in some cases, the overfilling of the venous sinuses appears to precede the reflex symptoms. Then the nose and eyes begin to pour out their secretions, the eyelids swell until they are almost closed, and the lachrymation adds to the profuse discharge from the nose. The attack will persist in varying intensity from a few minutes to several days, according to the sensitiveness of the patient, the intensity of, or the length of exposure to, the initial source of irritation, and the anatomical condition of the nose. The discharge from the nose is sometimes extraordinarily profuse. One of my patients declared that she would saturate a large towel in the brief space of half an hour. When the attack is prolonged, there is generally more or less depression, mental as well as physical, especially in those patients who are markedly of a neurotic temperament. Even after the sneezing has ceased, the rhinorrhœa may continue for many hours, and is sometimes continuous during the whole of the season. In rare cases the temperature is said to be raised, though this I have never observed. Occasionally in very severe cases there may be some photophobia, and the discharge from both nose and eyes may become muco-purulent. Sometimes, after the persistence of the coryza for a few days, there is added, as a further trouble, spasmodic asthma, which differs in no material way from ordinary attacks of the affection; not infrequently it constitutes the whole trouble. This I have on two occasions noticed in patients who habitually, all the year round, adopted

buccal respiration from grave structural stenosis—in the one from ecchondrosis of the septum, and in the other from post-nasal adenoids. So that in these cases, at any rate, it is probable that the asthma was induced by direct irritation of the bronchial mucous membrane rather than by a reflex action originating in the nose. In another of my cases, as has been already remarked, the asthma supervened after the nasal symptoms had persisted for nine years, and that only after the nose and eye symptoms had been cured by intra-nasal operation (Case I.). The bronchial spasm never presents such gravity as is seen in bronchitic asthma; and, its duration extending at the worst over only a few weeks in each year, as the consequence of pollen irritation, it never leads to emphysema of the lungs.

The symptoms are not materially different in those cases in which the exciting cause is other than the pollen of different plants. In such we sometimes find a daily recurrence of the attack at a constant hour, usually in the early morning, and tending to subside as the day advances. These attacks are also accompanied by great depression, and the subjects are generally of a neurotic temperament. They are sometimes extraordinarily sensitive to every sort of stimulation of the nose, either internally or externally. Thus in one of my patients, a lady of highly-strung and excitable temperament, the insertion of the nasal speculum was sufficient to induce an attack of sneezing which would last for two or three hours afterward. She assured me, moreover, that, when she was overtired, it was sometimes sufficient to feel the breath of another person on her face to induce the whole train of symptoms, entailing the use of a dozen pocket-handkerchiefs, or more, before the attack would terminate. In these cases asthma, in my experience, is less frequent than in those due to pollen-irritation, though we not infrequently see attacks of spasmodic or bronchitic asthma, the result of exposure to cold, beginning with paroxysmal sneezing. Or again, when dust is the source of the irritation, we occasionally find asthma added to the physiological nasal reflex.

Examination of the nose during an attack reveals nothing beyond the ordinary symptoms of acute and chronic catarrh. In old-standing cases not infrequently the inferior turbinated bodies present a remarkable pallor of surface. During the intervals of the seizures we may observe any of the conditions met

with as the results of chronic rhinitis, needless to enumerate. Especially often are encountered hypertrophies of the septum and inferior turbinated bodies; while polypus, less frequently observed in association with pollen-irritation, is without exception the most usual direct cause of paroxysmal sneezing.

The prognosis of these cases is favorable so far as the termination of the actual attacks is concerned, and especially in those cases confined to the early summer months. In the course of time the symptoms appear to lead to actual hypertrophies of the inferior turbinated bodies or of the septum—though of the latter one can make no positive statement. Certainly one finds many cases where the obstruction in the nose is said to be steadily on the increase, although the sneezing, etc., occurs only in the summer. Some cases, moreover, beginning in the summer, and at first occurring only then, gradually in the course of years begin to persist throughout the year, until the nose becomes permanently obstructed. Some few cases appear to lose their sensitiveness as they grow older, though these would presumably be cases where there was no structural fault or hypertrophy. As regards the results of medicinal treatment, the prognosis cannot be said to be favorable beyond the momentary relief afforded. But to this statement there are occasional exceptions, as will be related immediately. On the other hand, the prognosis, after judicious surgical treatment in selected cases, is highly satisfactory, if we hope for something short of absolute cure in cases of pollen catarrh. Where paroxysmal sneezing persists throughout the year, aggravated or not during the pollen season, we may, in most cases where there is positive stenosis of the nose, however slight, hold out hopes of actual cure. Such cases, moreover, if left to themselves, decidedly tend to grow worse rather than better. As has been already remarked, when hay asthma accompanies the nose symptoms, we are compelled, prognosticating concerning the former, to speak more guardedly than when referring to the latter. We must, moreover, remember the possibility of rendering the asthma worse as a consequence actually of the improved condition of the nose. Nevertheless, the asthma symptoms, at their worst, are never very distressing, the patients generally considering them of quite minor importance. Moreover, there is not the least fear of this form of asthma leading to emphysema of the lungs.

CHAPTER III.

TREATMENT.

THE treatment of the pollen-form of the complaint in those cases where there is no opportunity of surgical interference is decidedly less satisfactory. The patients are compelled to seek those resorts which, from their geographical characters, will expose them least to the possibility of encountering the contamination. Cities and the sea-coast are pretty generally found to afford a certain amount of immunity from the severer symptoms; but a sea voyage, especially to the tropics, is the surest means of escaping. Those who are inevitably compelled to reside in the country during this season, should avoid being out of doors during the hottest part of the day and when the wind is high; they should eschew severe exercise, rapid movements, riding and driving, seeing that the greater the velocity of the current of air encountered, the greater the exposure to the irritating particles carried by it. When out of doors, these patients are compelled to wear blue spectacles, to plug the nostrils with cotton wool, and to wear substantial veils. Nothing finer than the material known as gossamer appears to be of much use, and such a covering to the face in the summer months is unpleasantly warm. Altogether the patient's life under such circumstances is not to be envied. Medicinal treatment is not of much avail. Seeing that most of these patients are of the neurotic temperament, and that the affection is in itself exceedingly exhausting, everything possible must be done to sustain the energies. Nerve tonics, assafœtida, and valerian are said to be of some value, while most of the patients are the better for a small amount of stimulants.

℞ Zinci valerianatis, ... gr. i.
Pil. assafœtidæ co., ... gr. ij.

M. ft. pil. i. Sig. One or two pills to be taken two or three times a day. (Sir Morell Mackenzie's pill for neurasthenics suffering from hay fever.)

Innumerable local remedies may be mentioned as having been more or less strongly advocated by one authority or another; but their very number proclaims their uselessness in the vast majority of cases. Chloride of ammonium vapor, Ferrier's snuff, compound tincture of benzoin as an inhalation, have all proved useless in my hands, beyond giving a very transitory relief. Some find tobacco smoke of advantage, while others praise the cubebs cigarettes. The opium pipe has been strongly recommended, and I have known of its giving more relief than anything else. A very few whiffs are sufficient, and there is no very cogent objection to its employment. But of all local applications I have found the most conspicuous benefit from a spray of very weak chromic acid, one-eighth to one-sixteenth of a grain to the ounce of water:

℞ Acid. chromici cryst., . . . gr. $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$.
Aq. destill., ... ℥ i.

Ft. nebula. Sig. To be diluted with an equal quantity of boiling water, and sprayed into the nose for two or three minutes, twice or three times a day. (For paroxysmal sneezing and rhinorrhœa. To be used with caution.)

This should be sprayed warm into the nose for five minutes three or four times a day, according to the severity of the case and the relief experienced. One of my hay-fever patients, who considered herself cured after the removal of a small ecchondrosis of the septum, is yet unwilling to relinquish her chromic spray. This she keeps at hand, and in the early summer months, on experiencing the least discomfort in the nose, has immediate recourse to the remedy, which she declares never fails her. In another similar case, not of the severest type, the patient was completely cured after a week's use of the remedy. But it must be confessed that in the majority of instances it proves quite inoperative. Similar in its action to this is perhaps the perchloride of mercury, which two years ago was being strongly advocated by different medical men who had tried it on their own persons upon the recommendation of Dr. Carl Genth.[24] It consists in the application to the conjunctiva, at the first warning of the symptoms, of a solution of corrosive sublimate of a strength of 1 in 3,000. This was to be applied after each exposure to the influence of the pollen. It is said to arrest almost completely the subsequent symptoms. But of its efficacy I have had no experience.

Of all remedies none is so likely to give relief as cocaine, applied, in one way or another, to the mucous membrane of the nose. When first used, it is usually infallible in giving more or less complete relief. But its effects rapidly pass away; and after using the remedy for any length of time, it invariably becomes necessary to increase the quantity applied to a great extent. A solution of 4 per cent may probably be used with impunity, especially if care be taken that it runs rather out at the nose than into the throat; but when 10 and 20-per-cent solutions are necessary to produce the desired effect, the nervous system will almost inevitably suffer. Of this fact I have seen several instances, two occurring in medical men. Dr. Windle,[25] in speaking of the use of the drug in his own person, stated that the advantage accruing from it was more than counterbalanced by the serious general derangement of the nervous system which its prolonged use engendered; and Dr. W. S. Paget makes a similar observation drawn from his personal experience.[26] So that we are probably justified in hesitating to prescribe so potent a remedy, if such it can be called, when at best its effects are but transitory.

Sir Andrew Clark[27] has recommended in the strongest terms a method of diminishing the irritability of the nasal mucous membrane which he has adopted for many years. It consists in the application to the nasal fossæ, and, if necessary, to the naso-pharynx also, of a solution of quinine and perchloride of mercury in glycerin of carbolic acid.

℞ Glycerini. acid carbol., ... ℥ i.
Quiniæ hydrochlor., ... ʒ i.
To be dissolved with the aid of heat and one two-thousandth part of perchloride of mercury added.

To be applied with caution to the nasal mucous membrane on alternate or every three days. (Sir Andrew Clark's remedy for hay fever.)

He directs it to be applied with a camel-hair brush on alternate or every three days. He gives very minute direction as to the precise method of treatment. There is, of course, no disputing that the learned physician has had remarkably good results from this treatment; but, after having had the intense suffering produced by the process detailed to me more than once, I have hitherto hesitated in applying it in any of

my cases, and shall hardly do so until I meet with one where other means have failed.

The only scientific and practical method of treating the affections comprised under the terms "hay fever" and "paroxysmal sneezing" is surgical, and then only so far, in my experience, as the nose presents abnormalities of structure, due either to hyperplasia or hypertrophies. Polypi, of course, must be removed as well as enlargements of the inferior turbinated body, both of these being frequent sources of paroxysmal sneezing, though polypi are uncommon in the typical hay fever. Vascular engorgement of the inferior turbinated body is frequently encountered as a fruitful source of increased sensitiveness of the mucous membrane, in all grades of the symptoms. But most frequently we have to deal with ecchondroses and exostoses of the septum, even when so small as to cause no material encroachment upon the calibre of the fossæ. I have sometimes found the removal of a small inequality of the surface when the position was such that the least swelling would bring it in contact with the middle, or less often with the inferior turbinated bodies, sufficient to cure completely the most distressing symptoms of many years' standing; while the results are no less conspicuous when dealing with larger hypertrophies coming in contact with the inferior turbinated during its temporary erection. Disease of the middle turbinated, excluding for the moment polypus, is quite exceptional as a cause of paroxysmal sneezing in my experience; while I have never met with disease of the bone, except in one of the cases of cyst of the middle turbinated already mentioned, producing conspicuously paroxysms of sneezing. From the results of treatment in my successful cases, I am strongly of opinion that the anterior portions of the septum are the regions the irritation of which most frequently gives rise to the reflex symptoms in question. This also would appear to be the view held by Sajous, who advocates the linear and punctate application of the galvanocautery to certain sensitive spots on the septum and on the outer wall in front of the middle turbinated. These sensitive spots can be discovered only by the exploration of the surface with the cautery-point itself before rendering it incandescent. Cocaine must not be used; and, as soon as the patient communicates the fact that the point touched is sensitive, the

button is pressed, and the cauterization made immediately. It is said to be not very painful if the heat is of a cherry color. Chemical caustics may be applied in a similar manner with a *porte-caustique* designed for the purpose.[28] My experience in this mode of treatment has been confined to a single case, and in this one the benefit was not conspicuous; but I hope to give it a further trial.

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ARTIFICIAL RESPIRATION:

THE THEORY AND PRACTICE.

BY

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ARTIFICIAL RESPIRATION.

CHAPTER I.

THE THEORY OF ARTIFICIAL RESPIRATION.

THIS subject is one which, for the last hundred and twenty years, has, from time to time, called forth the study of the experimentalist, and after him the practitioner; but nothing as yet has been sufficiently carried out in a strictly scientific and uniform manner. When the moment arrives—always an urgent moment—for artificial respiration to be demanded, no two practitioners seem ready to follow the same plan, and few have had sufficient experience to decide, absolutely, which is the best plan. In some of the public institutions for the recovery of the drowned one method is followed, in others another; but comparisons have been wanting, hitherto, of sufficient value to lead to any sound and reliable line of practice on which to establish a definite principle of action. It is my wish in this paper to attempt to point out how to arrive at something like uniformity of action both in principle and in procedure.

In order to make a methodical as well as a concise essay on artificial respiration, let us study the subject under four heads: the theory; the practice; the value; and the expectation.

The theory of artificial respiration is, that by restarting the process of respiration immediately after it has ceased to be carried on by the natural process of breathing, the natural process may be restored, and life—in some cases, at all events—may be saved. Experiment has shown that, for a period of three minutes after air has ceased to be drawn in by inspiration, the vital functions may still be carried on by the reserve air in the lungs. Under practice a longer term of suspended life may be acquired, as in divers, one of whom, to my own

knowledge, could remain under water, and therefore without respiring, for five minutes and twenty seconds; but we may accept that in the majority of persons three minutes is the full time of possible suspension of human life, in the absence of respiration.

After the body has ceased to live on the reserved air, various changes rapidly occur, even when the obstruction to respiration is of the simplest kind. Some obstruction to the entrance of air into the lungs, or congestion of blood in the lungs, may be the direct mechanical embarrassments; the blood in the pulmonary vessels may coagulate, and render the most perfect artificial respiration useless; the arterioles of the pulmonary artery may be firmly contracted, so that no blood can be carried to meet the air on the respiratory surface, however skilfully air may be sent to that surface; the right side of the heart may be temporarily overwhelmed with blood, or the left side may be incapable of contraction or dilatation; and, lastly, the muscles of respiration may be incapable of action, either from spasmodic closure or by the opposite state, that of paralysis. Theory, therefore, strictly interpreted, would teach that artificial respiration can only be expected to succeed in cases where the bronchial tract and vesicular structure of the lung is free; where the blood is fluid; where the heart is in motion; and where a current of blood is still passing over the pulmonic circuit from the right to the left side of the heart.

In carrying out artificial respiration, in any manner whatever, it is necessary, according to theory, to maintain the balance of the circulating and respirating systems. I mean by this the balance of pressure between the blood impelled into the pulmonic circuit by the contraction of the right ventricle of the heart and the pressure of the air that has to pass into the lung to meet the blood. In health this balance is perfect and the integrity of the vascular and vesicular structures of the lungs depends on the continuance of this perfection. Some recent statements, to the effect that artificial respiration conducted with great pressure of air has been successful, are so utterly inconsistent with all that has been observed, and with the natural method of breathing, that I am forced to let them pass as conveying some great error, or as being performed on too small a scale to be of any service in common

practice. When, under suspended respiration, the propelling power of the heart is reduced, as it always is under such circumstances, it is necessary to restore the respiration with the gentlest action possible. It is good, at such moments of action, to recall the simple experiment of bringing an expiring candle-wick into flame by breaths of air. The two processes are identical: the operator is blowing into life a flame of life which is all but exhausted, and which the least rudeness may extinguish for good.

A sound principle to be observed relates to the repose of the body during the process. The body cannot be resting too quietly while the lungs are being filled and emptied of air. The reason of this is that the heart has to be considered as well as the lungs. Any excessive motion interferes with the cardiac contractions, mechanically, and any muscular movement exhausts the circulation just at the moment when the restoration of power calls for the fullest conservation. The respiratory muscles, and especially the diaphragm, demand also every possible influx of force for their work, upon the renewal of which life entirely depends. The position of the body, both for the work of the heart and of the diaphragm, should be exactly in the horizontal line, and nothing should be allowed to take it from that line except the removal of fluid or other substance causing obstruction.

It is important that the air introduced into the lungs should be warmed. If there be no better means at command than an open fire, the advantage of that ought not to be lost. The body should be brought as near as possible to the fire, and the warm air from the fire should be used for the inflation. But the true thing is a warm room, like an engine room or hot-air bath room, in which the air, in every part, is full 90° Fahr.

The quantity of air to be thrown into the chest artificially is a matter of much moment, and one to which I have at various times paid a considerable amount of attention. The vital capacity of a full-grown, well-developed, healthy man shall be, say, 376 cubic inches. He can take this measure of air into his lungs at once if he make a special effort. But even in the case of a man having this capacity, not more than fifteen cubic inches are required at each inspiration for the support of good vital action. I made this important point a matter

of direct experiment on myself, and found the measure of air named fairly sufficient so long as I remained in repose, either in the erect, the sitting, or the recumbent position. In the performance of artificial respiration we may, therefore, accept fifteen to twenty cubic inches of air as the minimum to be used at each introduction of a charge of air into the lung. It may be assumed that the introduction of four times this quantity would not be too much; but it may also be assumed that the smaller amount named is, under most circumstances, sufficient.

Another theoretical point relates to the diaphragm. When artificial breathing has been set up, the action of the diaphragm, so important in natural respiration, is lost. This fact cannot be over-estimated, for the diaphragmatic contraction is the chief agent under the natural process. It would seem, therefore, *à priori*, to be good practice to excite the diaphragm. But theory indicates, at this present stage of our progress, that to excite the diaphragm, by stimulation of it, is to interfere unfavorably with the action of the heart. We have, consequently, if we follow theory, to let alone the great inspiratory muscle, and leave it to resume work in the course of its own natural revivification.

It has been suggested, theoretically, that in inflating the lungs artificially it would be advisable to use pure oxygen, or an air containing an excess of oxygen, instead of common air. If the theory were true it would be embarrassing, because during the sudden emergencies in which the artificial method is demanded the means of obtaining pure oyxgen would, usually, be difficult. Fortunately, theory in this case is not supported by experiment; for I found by direct comparative experiment that the attraction of blood for the oxygen of the common air was better than for oxygen alone in the artificial process. The presence of the atmospheric nitrogen seemed to have a good effect by distribution of the oxygen into the vesicular structure.

CHAPTER II.

THE PRACTICE OF ARTIFICIAL RESPIRATION.

THE practice of artificial respiration may be carried out in one of the following ways: (*a*) by the manual method, or direct method, as some describe it; (*b*) by immediate insufflation, or the mouth-to-mouth method; (*c*) by intermediate insufflation, or the bellows method; (*d*) by insufflation combined with manual expiration; (*e*) by electrical excitation, simple or in combination with insufflation. These plans have all their own advantages and disadvantages. In order to estimate their respective merits, we will take them into consideration in the manner in which they are arranged above.

THE MANUAL OR DIRECT METHOD.

This method, the one usually resorted to in cases of drowning and other mechanical forms of death by asphyxia, is brought into operation in many different ways. The simplest is that which was followed by Cullen and his school after the discoveries of Black had put aside mouth-to-mouth insufflation. This manual process consisted simply in laying the patient on the back, making pressure firmly on the chest and abdomen, so as to empty the chest of air, and then setting the compressed parts at liberty, and allowing the chest to refill by its natural resilience and expansion. It is not to be denied that this simple method has many advantages, and in young subjects, in whom the resiliency of the chest walls is good, it is an effective procedure. In stillborn children it is very effective, and it is not likely to pass out of use. It remained the only system of its kind for over fifty years; until, in fact, the ingenious Marshall Hall replaced it by the system which bears his name.

The Marshall Hall plan is carried out by laying the body in the horizontal position, and giving it a gentle movement

from the side toward the fore part of the chest, and back again, in what may be called cradle fashion, the arm being close down by the side. With the backward movement the body should be pulled a little over toward the back. This mode of artificial respiration is simple, and in most cases ready. It has the effect of partially emptying the chest of its contained air, and of refilling it with outside atmospheric air; and, from its simplicity, it has been much patronized. Its disadvantages are that it is difficult to carry it out on a soft, yielding surface like a bed, and on the narrow operating-table.

Another manual process is that introduced by Dr. Sylvester, and known by his name. It is performed by moving the arms of the patient. The body is laid prone, or with the trunk somewhat elevated, and the arms are raised by the elbows above the head, and are afterward brought down to the sides, repeating the act several times a minute. This is a very good plan indeed; it causes the chest to expand and draw in a fair volume of air and it empties the chest of contained air, by easy movements.

A third manual method was brought into practice by Dr. Howard, of New York, and bears his name. It is performed by placing the patient on his back, after emptying the chest and throat of any contained water; putting a hard roll of clothing beneath the back; bending the head well backward so that the throat may be on the stretch to the fullest degree; fixing the hands of the patient over the head by a tie, a handkerchief, or piece of cord; and, finally, kneeling astride the patient's hips, grasping the front part of the chest toward the pit of the stomach, the thumbs pointing to the chin and the fingers fitting into the grooves between the short ribs, and firmly pressing the sides of the patient together, bringing at the same time the whole weight forward, so as to empty the chest by compression, and leaning back to let it empty itself by the recoil of the ribs, repeating the movements from seven to ten times a minute.

A fourth manual method has recently been introduced by my friend Dr. Andrew H. Smith, of New York. In this method the patient, in the recumbent position, is placed, if possible, on a table, at which are two operators. One operator, at the head of the table, takes a hand of the patient in each of his, and draws the arms upward with a slow and steady pull, con-

tinuing the traction until the maximum of thoracic distention is obtained, in about three seconds. The traction is then relaxed, upon which the other operator, kneeling or standing by the side of the patient, presses with both hands forcibly upon the chest in a direction backward and toward the median line, so as to diminish both the depth and the breadth of the lower half of the thorax, which expirating pressure is continued for two seconds. Both sets of actions are repeated twelve times a minute. This method, a combination of Sylvester's and Howard's, is effective without being laborious. Its disadvantage is that it necessitates two operators.

Lastly, under the direct manual processes may be named a plan suggested by myself, which consists in placing the body of the patient in the sitting position, and letting the right hand be firmly grasped by the right hand of one person, the left by the right hand of another person, standing on their respective sides. Each operator now lifts the hand he has in charge upward in an oblique direction until the limb is well stretched, and raises it with sufficient force to lift up the body very slightly. Then, simultaneously, the two let the arms down to the side, flexing the forearm on the upper arm, and bringing the upper arm in close proximity to the side with firm pressure, using the forearm as a lever, and repeating these acts ten to twelve times a minute. By the first of these acts the thorax is made to take in a good volume of air, and by the second it is made to throw out an equally good charge. The advantages of this method are that the labor required of each operator is not severe, and that in the process of raising the body the diaphragm descends, making inspiration very nearly natural. The disadvantages are that two persons are required to keep up the operative procedure, and that a third person should take part in holding up the body in the sitting position.

The Immediate Insufflation Method.

This method, which predates the time of Black and the discovery that carbonic acid is given off by the breath, was advocated by Dr. Fothergill, who flourished in the last century. By it the operator instilled his own breath into the lungs of the person whom he was trying to restore. He placed his mouth to the mouth or nostrils of the patient, or, as was the

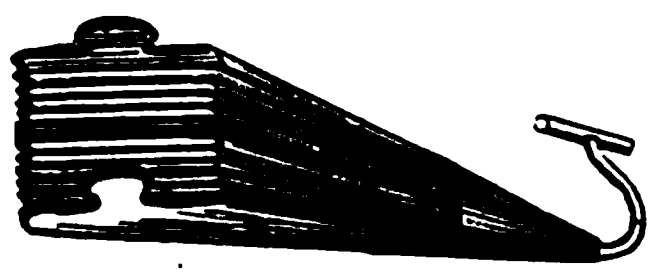
more common as well as more desirable practice, he made a funnel of his left hand, placed that by the outer part over the nostrils, and closing the mouth of the patient, and putting his own mouth to the opening of the funnel formed by his thumb and forefinger, he breathed through the funnel backward and forward so as to empty and fill the lungs of the patient. The plan thus devised was considered, at first, effective; but, after the discovery that in expiration the poisonous gas, called originally fixed air—carbonic acid—is given off by the lungs, it was argued that to pour the exhaled breath of one human being into the lungs of another human being was to commit a grave physiological error, and to intensify the bad condition which was already present. The objection is partly valid, but the method, after all, is not without its advantages. It introduces warm air, and it regulates quantity exceedingly well.

Intermediate Insufflation—The Bellows Method

A change of method was introduced by John Hunter, who invented a pair of double-acting bellows for artificial respiration. They consisted of bellows with a central partition, giving two cavities ending in a single nozzle. When the bellows were opened one of the cavities filled, through a valve, with pure air from the atmosphere, while the other cavity filled, also through a valve, from the nozzle. In use the nozzle of the bellows was inserted in the nostril of the patient, and then the bellows were worked in the ordinary way. The result was that the air from the lungs of the patient was drawn into one side of the bellows as they were expanded, and common air into the other side. The bellows then contained two charges of air, one impure the other pure. When the bellows were being closed, the air which had been drawn from the lungs was expelled into the open air, and that which had been drawn from the open air was driven into the lungs. Thus a double current was set up as in ordinary respiration, and the natural process of respiration was imitated.

Very early in my experimental career, without being aware, at the time, of Hunter's bellows, I constructed bellows on a similar principle, and have used them until this day, on many occasions. They withdraw and deliver out ten to fifteen cubic inches of gas very readily, but I cannot say they are altogether convenient for the requirements of the practitioner;

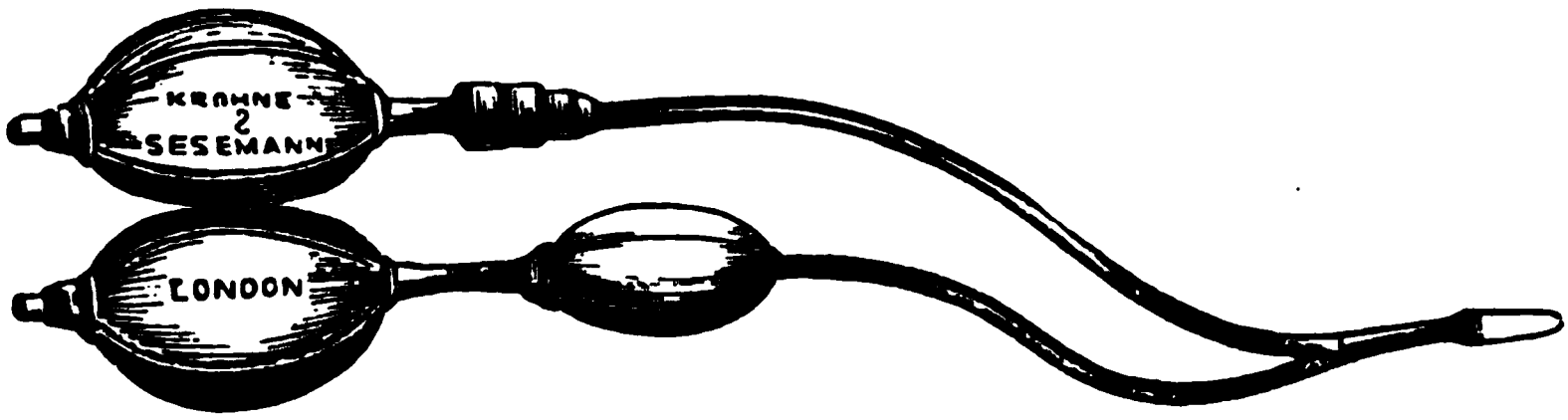
they take up a considerable amount of room, and they are rather clumsy in work. The appearance of the bellows is subjoined. They are worked in the same manner as ordinary bellows, and an elastic tube is easily passed over the nozzle to go to the nostril or mouthpiece applied to the patient.



A few years later I invented the double-acting india-rubber bellows for artificial respiration generally known by my name, and which are more practical than the abcve. They can be carried in the pocket, and are as portable as need be. They consist of two india-rubber hand-bellows, which may be joined together or may be separate, according to choice. The bellows terminate in one common tube, that may be called the nostril tube, and each bellows will contain four cubic inches of air. They are so valved that when, after being compressed together, they are allowed to expand, the one fills with common air and the other, after the nostril tube is inserted in the nostril, with air from the lungs. During compression the air in the bellows containing the pure air is forced into the lung, while the bellows containing impure air is expelled into the open air. When the compression is taken off the bellows fill on both sides, one side from the common air, the other from the lung—that is to say, from the air that ought to be expired by the patient; one side, in short, is supplying while the other is exhausting. To the supply side is added a small bag or reservoir, very elastic, in order to prevent undue pressure being made upon the lungs.

In using these bellows the nostril tube is inserted in the nostril on one side, so as to fill the nostril completely; then the other nostril is closed by pressing with the left finger and thumb, firmly, on the nostril tube, and the bellows are worked with the right hand. If the chest of the subject be small, as, for example, the chest of a newborn child, both bellows may be worked at the same time; but if the chest be large, the chest, for instance, of an adult man, five consecutive strokes may be made with the bellows which fills the lungs, and then

three with that which empties them. In this way natural respiration can be very closely imitated, and the lung can be filled and emptied ten times in the minute without any danger of mechanical injury from the action. I have inserted a diagram of these double-acting elastic bellows in a previous article on the subject, but I repeat it here, as a necessary part of the present article. They answer exceedingly well, and I have had the most satisfactory results from their use. The disadvantage of them is that they are apt to become hard in structure in course of time, and do not then act so freely as is desirable.



The simplest bellows plan of all, and in my opinion the best of every plan, is the following: Take a piece of soft india-rubber tubing, one quarter of an inch in diameter and two feet long. Into one end of this tube insert a short tube of bone or vulcanite, to make a firm tube for insertion into one nostril; pass the other end of the elastic tube to the nozzle of a pair of bellows—hand bellows such as are used for ether spray, or a pair of parlor or kitchen bellows, as may be most handy at the moment. Insert the nostril tube into one of the nostrils of the patient, and, standing on the right side of the patient, take the nostrils in the grip of the left thumb and finger; compress the free nostril on to the tube, and with the right hand, or, better still, by the hands of an assistant let the chest be gently inflated with air, until it is seen to be filled. At this point remove the pressure from the free nostril, and allow the lungs, by their own elasticity, to empty themselves, assisting the movement, if necessary, by gentle pressure on the abdomen. These acts may be repeated ten times in the minute. The method is very effective, and is not fatiguing; but it has the disadvantage of requiring two persons to carry it out effectively.

The Method of Electrical Excitation.

I once devoted a considerable time in research, by the experimental method, in order to discover if by electrical excitation, simply or combined with artificial insufflation, natural respiration could be established after it had been suspended. The results were unusually important, although negative in a practical sense. I got Messrs. Krohne and Seseman to make for me a double-acting bellows so connected with a faradic machine that at each compression of the elbows a current passed. A metal wire from the bellows attended the nostril tube, and formed, very conveniently, one of the electrodes. The other electrode from the battery terminated as a needle, and was connected to a button within the bellows, which could, by compression, be brought into contact with another button connected with the nostril wire. In action, whilst the bellows were filling with air, there was no shock; but when they were closed, and the lungs were filled, a shock, of any strength desired, was delivered. By introducing the needle from the free electrode into different parts of the chest, into the pectoral muscles, or into the diaphragm, muscular action could be produced, so long as any vitality remained, at the moment the chest was charged with air by the bellows. It was quite remarkable to observe after death by chloroform how well this plan answered in producing inspiration and expiration. Under it a good vesicular murmur could be obtained, when the diaphragm was made to contract, and loud laryngeal sounds were often uttered. Yet the results were always indifferent, from the circumstance that under the electric excitation which called forth the contractions of the diaphragm, the heart was paralyzed and the circulation was brought to a stand.

In other experiments I succeeded in setting up good inspiration and expiration through electric excitation alone, *i.e.*, without the bellows, by inserting the needle of one electrode into the larynx and the needle of the other electrode into the diaphragm, and by making and breaking contact every ten seconds regularly, under the direction of a metronome. The effects were the same as when the bellows were used with the current; the excitation which called the diaphragm into play produced paralysis of the heart.

CHAPTER III.

VALUE OF ARTIFICIAL RESPIRATION.

ARTIFICIAL respiration is such a ready practice, and at first sight seems to promise so much, we wonder, after a few years, why such a little comes out of it. I have heard a practitioner of long experience say that he never was sure of having seen any good from it. He had seen what looked like success following upon its use, but never after the vital irritability of the respiratory muscles had been lost. He adduced, in proof of this statement, a well-known instance that had come under his own observation, in which the captain of a vessel and three of his men, after being capsized in a boat, were carried on board a steamer in the same state of apparent death from submersion. The captain was carried into the cabin, where the surgeon and his assistants used every effort of artificial respiration to restore him to animation, without avail. The three sailors were simply carried down to the engine-room and there, at the high temperature, they all came rapidly back to life without other assistance from any one. Something like to this is sometimes seen in experimental work. I remember a lecturer bringing to lecture a kitten that had been drowned, and had been under cold water for three hours, in order to demonstrate to his class some anatomical fact connected with the heart. He had wrapped the little animal in wool, and had put it into the pocket of his under-coat; but when he came to take it out he found it breathing regularly. It recovered, and grew up to become the favorite cat of the household. It is, therefore, not always easy to say if results seen to follow upon artificial respiration are *post hoc* or *propter hoc* the artificial procedure. The only way that I saw open for assurance on this point was to put two animals of the same age and kind into the same anæsthetic chamber, and let them both sink into death; then remove them, lay them on the same table, at the same temperature, and set up arti-

ficial respiration in one, while the other was left to its fate. This is absolute proving, and it gives an absolute result when it is properly carried out. I have carried it out many times, with the result that life can be restored to the animal that has been subjected to the artificial plan, while the animal left to its fate remains dead. I could make this demonstration at any time, and I have often made it at my lectures on resuscitation. It offers, perhaps, a correct and complete view of the sum total of value of the artificial respiratory process.

And here I may state, at once, that this demonstration teaches several lessons. (1) That if any good is to come from the artificial method it must be set up at once. (2) That so long as there is natural breathing, however slight it may be, it is better than artificial. (3) That when under the artificial method the natural is re-established, it is right at once to let the natural have place, and to cease all further attempt at the artificial so long as the natural is in progress. (4) That until return to the natural act takes place, it is wise to continue the artificial aid so long as the muscles remain flaccid and the blood in the veins remains fluid. (5) That in carrying out the artificial method no force is necessary, and that any extreme force is dangerous to the lungs by imperilling structures that may be easily ruptured if subjected to undue stress or sudden violence.

The reason for these few observances are of great weight, since success or failure depends on several minor circumstances, which put together make up an important major result. If from the mode of death the heart and the breathing organs have failed simultaneously, the lapse of a very few moments suffices to render the artificial process inoperative for good. Like Hooke, I have seen the motion of the heart restored in inferior animals by inflation of the lungs, but never after the right heart has failed to contract for a period of thirty seconds in both its cavities; so that we may consider this mode of arrest as extremely fatal. Again, when the action of the heart continues on the right side, if the pulmonary arterioles be contracted, the chances of recovery, under artificial inflation, are extremely small, because it generally happens that before the pulmonary vessels relax the blood contained in the pulmonary tract undergoes coagulation, and thereupon all attempts at re-establishing the pulmonic current

is out of the question. Once more; the blood, though it may be in circuit, may not be in a condition to assimilate oxygen, and artificial respiration, however long applied, may then fail. Lastly, in some forms of death, commencing at the lungs, there seems to be a determinate failure of power in the nervous centres to sustain the respiratory movements independently, and then death occurs, even after indications of consciousness have been seen as the result of the artificial method. Thus, as I taught in 1869, the value of artificial respiration is always somewhat limited. To insure its success there must be; (*a*) motion of the heart; (*b*) open pulmonary vessels; (*c*) fluid blood; (*d*) blood that will undergo natural oxidation; and, (*e*) continued vitality of the nervous and muscular systems.

It is essential to submit these difficulties, in order to prevent the wonder and disappointment which are so often felt after failures, upon false promises of success, made on narrow experience and little knowledge. The statements which sometimes are allowed to go the round of the press, and which even find their way into scientific journals, to the effect that a new mode of artificial respiration has been discovered, under which life may be restored in all cases of death from suffocation and from narcotic vapors, if the attempt be only continued for a sufficient length of time, must be taken *cum grano.* It is true that extraordinary success does now and then follow prolonged artificial respiration, but such success is only obtained under specially favorable circumstances, when every condition leading to recovery is in train for recovery.

CHAPTER IV.

THE EXPECTATION FROM ARTIFICIAL RESPIRATION.

WHILE the facts named above are still fresh on the mind, it will be in place to indicate the conditions of sudden dissolution, during which artificial respiration may and may not be expected to prove of service.

ACTIONS OF GASES AND VAPORS.

We may consider, in the first instance, deaths from inhalation of narcotic and other poisonous gases or vapors.

Gases and vapors capable of arresting respiration on being inhaled may be divided into two classes: one which may be called negative in action; another which may be called, for want of a better term, positive or irritant. If I see before me a table of specimens of these substances I can pick out each kind, and can tell, at the same time, those which would allow of recovery under artificial respiration, and those which would not, or, at all events, would allow the least chance of recovery. As a rule, the negative in character are least injurious, and permit the best recoveries by the artificial method. These run as follows, according to my observation of their action and of the effect of artificial respiration after they have caused arrest of vital action by the lungs:—(*a*) Nitrogen; (*b*) hydrogen; (*c*) nitrous oxide; (*d*) marsh gas; (*e*) methylic ether. After these following next in order: (*f*) heavy carburetted hydrogen; (*g*) vapor of sulphuric ether; (*h*) methylal. From suspended life after the inhalation of any one of these substances, recovery may be secured by artificial respiration, as a general rule, if natural respiration has not been suspended longer than from ninety to one hundred and ten seconds, before the artificial respiration has been commenced.

The reason why artificial respiration is so often successful after apparent death from inhalation of the agents enumerated,

arises, I think, from the circumstance that they are all more or less inert. Received into the lungs, and passing, by diffusion, into the blood, where they displace a portion of the gases belonging to the blood, they inflict no more injury than occurs from displacement. They do not stimulate muscular action; they do not cause contraction of the arterioles, either of the pulmonary or of the general arterial system; they produce no disorganization of blood; and they lead to no serious molecular change of the nervous matter. When, therefore, they destroy life the process of destruction is due to changes incident purely to prolonged arrest of function, not to any chemical or physical change excited by their direct action on the structures with which they may come into contact. The immunity from death which occurs so repeatedly, year after year, in the human subject submitted to the influence of nitrous oxide gas, may be traced in this way to the negative action of the gas. The gas does not combine; it does not disorganize; it does no more than arrest the process of respiration and feed the blood for a brief period with an asphyxiating substance.

The success of artificial respiration, even in cases which seem to be the most favorable for its application, is not, however, uniform. The success may be modified by many accompanying circumstances, a fact which can only be correctly learned from experimental observation. I will state some illustrations as they have come before me during experiment. If two animals be submitted to artificial respiration after asphyxia, one with the stomach loaded with food, the other with the stomach empty, the one with the stomach loaded will not be restored, the other will be, all other circumstances being equally favorable, and the mode of artificial respiration being the same. If two animals be observed, in one of which there has been long deprivation of food, and in the other recent replenishment with time for digestion, the exhausted animal will not respond, while the well-fed animal will. If a young animal and an old one be the subjects under observation, it will invariably be found that the young animal will have many chances of recovery over the old one; in fact, a young, though apparently lifeless animal, may not actually be in danger, while an old one is hopelessly dead. Again, the temperature and condition of the air at the time of artificial respiration is all-important. At a temperature of 90° Fahr.,

with the air charged with water vapor to 30° on the hygrometric scale, there will be much greater probability of recovery than with an air at 50° Fahr., with a larger charge of moisture; again, a low and dry will offer a better chance than a medium and moist temperature. But the most important matter to remember of all is that success or failure depends largely on the time that has been expended in inducing the asphyxia. If the asphyxiated condition has been rapidly induced the recovery is easy, if recovery is to follow; if the asphyxia is brought about slowly, recovery is always difficult, and always prolonged. The explanation of this circumstance is simple enough. Under prolonged asphyxia the blood and all the tissues have been brought within the influence of the asphyxiating agent; the muscles are under its influence, and the nervous centres are under its influence; in plain terms, the whole body is under its influence, and, to re-start the breathing is merely to clear the breathing organs, and to wait there. Presuming that there be a minute current of blood passing over the lungs, from the right to the left side of the heart, that current properly fanned may be a means of escape after a long time of artificial respiration; but this result is uncommon, and very different from the quick transition from life to death seen after rapid asphyxia, when, although the death may be considered as certain, the recovery is induced, as by magic, under a few strokes of the artificial respiration.

I have been speaking above of negative gases and vapors. When we come to other bodies of the gaseous or vaporous class, which on being inhaled do more than simply replace air, that is to say, which act chemically on the blood, or are freely absorbed and held by the blood, or which, on being carried by the blood into the extreme parts, produce a physiological disturbance in muscular fibre, or in nervous matter, causing thereby a disconnection between nervous and muscular functions, we are on different ground altogether. In these conditions artificial respiration is of little value, except it be commenced immediately after the respiration has ceased.

So much for the value of artificial respiration after suspension of life by inhalation of narcotic vapors. It is necessary, next, to refer to its value after suspension of life from mechanical obstructions to respiration, as after drowning, strangulation, or other forms of mechanical suffocation. In my

experimental researches on suspension of life by immersion in water death was found to be remarkably decisive and rapid, except in the case of young animals, the elasticity of whose tissues causes a rapid emptying of the water absorbed into the bronchial cavities so soon as the body is placed in the open air. I have never seen recovery in a full-grown animal of any kind as the result of artificial respiration after five minutes' absolute immersion, with one exception, and that in the human subject. Under five minutes the success of the artificial process is striking, if it be done promptly and correctly. The first thing necessary for success consists in completely emptying the bronchial tubes of the water which they contain; a plan best carried out by lifting up the lower part of the body face downward, and making pressure on the abdomen and thorax. Until this is done, and the course is made clear for the free and easy entrance and exit of air, the mere act of driving air into the lung is calculated to do more harm than good, from forcing water, like a water wedge, into the air vesicles, causing rupture of the vesicles, with infiltration of water into the cellular tissue and destruction of pulmonary elasticity. When the lungs are free to receive air, then the artificial introduction and extraction of air is the one remedy. But now another element of practice comes into requisition, second only in importance to artificial breathing itself and that is the introduction of an air well warmed. A temperature of 120° Fahr. is not one degree too high for artificial respiration after drowning; and much of the failure which is met with after the very best method of introducing air rests on carelessness or inability to carry out the process in warm air. Warm air tells usefully in every way. It produces evaporation from the lungs, which is useful for oxidation; it favors evaporation from the skin, which, in its turn, favors circulation; and it restores warmth to the body at large, a great advantage of itself after the deprivation of heat to which the body has been subjected. In all hospitals and receiving-houses for the drowned, a room with a high temperature should at all times be ready for those who have been immersed. In steam vessels the engine-room is the place to which every person who has undergone immersion should be immediately carried.

When asphyxia has been brought about in the air, as in

cases of hanging, strangling, and suffocation, artificial respiration stands at its best as a means of restoring life. Presuming that in apparent death from suffocation no injury has been inflicted on the spinal cord, and no compression on the vessels of the neck, it is astounding to observe what rapid recoveries will take place after every sign of death, following upon mechanical suffocation, has been presented. In some instances the spontaneous return of respiration has been known to occur in criminals after suspension for a time long enough for the legal period enforced to insure the extinction of vitality; and the ease with which, in these and other cases, the body, after a long time of apparent death, can be called back to life, has to be seen to be accredited. In a boy upon whom I performed successfully the operation of tracheotomy for diphtheria, and who was suffocated afterward from plugging of the tube, life was restored by artificial respiration eleven minutes after natural respiration had entirely ceased. In these instances of pure asphyxia every condition is favorable for artificial respiration, and for recovery under it. The lungs are charged with blood; there is a chance that the current of blood between the right and the left side of the heart is not actually broken, though it may almost have ceased to move; and there is also a fair chance that the blood may not have undergone coagulation.

Summary.

The subjects considered in this essay may be summarized as follows:

Theoretically.—Asphyxia is the state of suspended animation in which artificial respiration may be expected to be of service. Under apnœa or syncope of the lesser circulation its value is problematical.

Artificial respiration is most likely to be effective, in young subjects, after negative modes of death, and after death rapidly induced.

Practically.—Artificial respiration should always be preceded by means for clearing the trachea and bronchial passages of all obstructions, solid or fluid.

It cannot be commenced too early after natural respiration has ceased.

It should always be carried on, when it is possible, in a warm and moderately dry air.

The best manual mode is, probably, that of Dr. Andrew H. Smith, described at page 168.

The best mode by insufflation, and the best mode altogether, when it can be done, is that by the nostril tube and bellows, described at page 172.

Artificial circulation should be continued so long as the blood in the veins remains fluid, and the muscles respond to electric excitation.

THE

NEWBORN INFANT.

ITS PHYSIOLOGY, HYGIENE, AND NOURISHMENT.

Together with its Commonest Diseases and their Treatment.

BY

DR. A. AUVARD, PARIS.

THE NEWBORN INFANT.

CHAPTER I.

THE hygiene of the child begins with its conception and depends, at that time and throughout pregnancy, upon maternal conditions; if these are satisfactory, the entrance of the child into life is a happy one, but if they are abnormal, it is unfortunate.

It is, then, with the pregnant woman that we must first occupy ourselves, giving her such advice and treatment that she shall bear a child of robust constitution.

For her comfort an abdominal bandage is to be recommended; for the vomiting of the first months no treatment is required unless it become serious; constipation may be met and overcome by rectal injections of oil, glycerin, or honey, or by gentle laxatives, such as rhubarb, cascara sagrada, and some mineral waters. Violent cathartics should be avoided. All severe exercise, like riding and dancing, long voyages or journeys, and whatever produces great fatigue, exert an unfavorable influence upon pregnancy. Moderate exercise, on the other hand, short drives or walks for an hour or two daily, should be allowed. Especial prudence must be employed at times corresponding to the regular menstrual epoch. Hot foot-baths may cause a rapid flow of blood to the lower extremities and should not be taken for this reason; but shower-baths and the spinal douche may be kept up during pregnancy, and for many women a cool sponge bath on rising is excellent. But no course of hydrotherapy should be begun during pregnancy. Sea-bathing need not be discontinued if the patient is well and the pregnancy is normal, provided it is not too fatiguing.

Warm-water baths at home at a temperature of about

90° F. should not last more than fifteen minutes nor be repeated oftener than every fifth day. This interval should be increased to eight or ten days during the last month. Vaginal injections are advisable, but must be discontinued during the last fortnight, owing to possible injury from the nozzle of the syringe or from the violence of the jet. At the same time, such injections may be required during the whole period if there is any vaginitis or if other conditions demand them. During the last two weeks of pregnancy, when premature delivery is not to be feared or is unimportant, it is well to use an antiseptic injection daily; for example, bichloride of mercury (1 to 4,000). This injection should thoroughly cleanse the cervix uteri, the vagina, and the vulva. After delivery the woman should gradually return to her ordinary mode of life by observing the following rules:

First Fortnight—Bed.

First week.—Dorsal decubitus during the first half; dorsal or lateral decubitus, as preferred, during the second half.

Second week.—The head may be raised by pillows in the first half; the patient may sit up completely in bed during the second.

Second Fortnight—Room or House.

Third week.—Patient may sit in an arm-chair in her room, remaining there an hour longer each day, and at the end of the third week may leave her room, but must keep to the house.

Fourth week.—Sofa and easy-chair. At the end of this week the patient may take her first trip in the open air.

Fifth and sixth week.—The patient may begin to enjoy drives and walks, but when she does not nurse her child and her courses return, usually about six weeks after parturition, she must keep quiet in bed or on an easy-chair during the first two days at least, or even during the entire flow.

When menstruation is re-established the woman returns to her usual life, and only after this time may the conjugal relation be again resumed without injury to her. But no fatiguing exercise can be indulged in before the fourth month after delivery, when the uterus has returned to its normal

condition. When the woman nourishes her child, and her menstruation is absent, she must avoid all fatigue of exercise or long journey until the infant is weaned; otherwise the health of both mother and child may be endangered.

Extreme care in attending the child and in providing suitable food for it is indispensable to assure its health and to protect it against the diseases which so often attack it. We proceed now to consider the four subjects of physiology, hygiene, aliment, and diseases of the new-born infant.

CHAPTER II.

PHYSIOLOGY.

Weight.

At the moment of birth a child weighs about 93.75 ounces avoirdupois, but during the first two days loses about three ounces. This loss it regains in the next five days, so that by

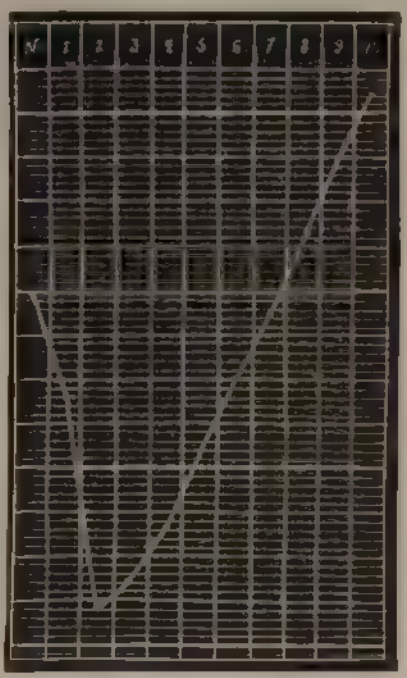


Fig. 1.—Curve of weight for the first ten days

the end of the first week its weight is the same as it was at birth.

The daily increase in weight after the first seven days is variable, but may be estimated about as follows:

During the first three months, 0.78 ounce a day.
" " second " " 0.63 " "
" " third " " 0.45 " "
" " fourth " " 0.30 " "

The total weight at the end of the first three months is about 10 pounds; at the end of the second quarter, 13 to 14

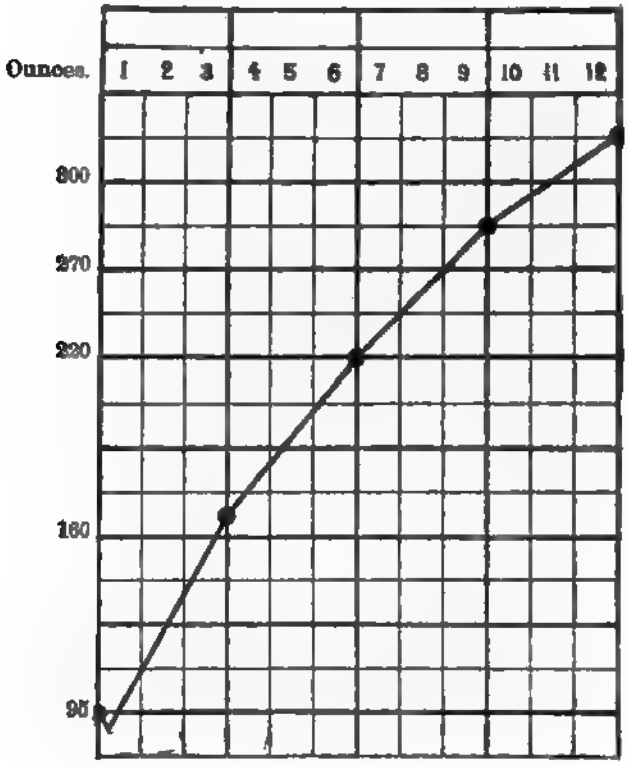


FIG. 2.—Weight curve during the first year.

pounds; at the end of the third, 16 or 17 pounds; and at the end of the year, 19 or 20 pounds.

This second curve shows the weight increase during the first year, and by it we see that the child's weight is more than doubled in the first six months and more than trebled during the second six months. A child which weighs 95 ounces at birth is a little above the average if it reaches 300 ounces at the end of the first year.

FIG. 3.—Basket-scales (Exupère).

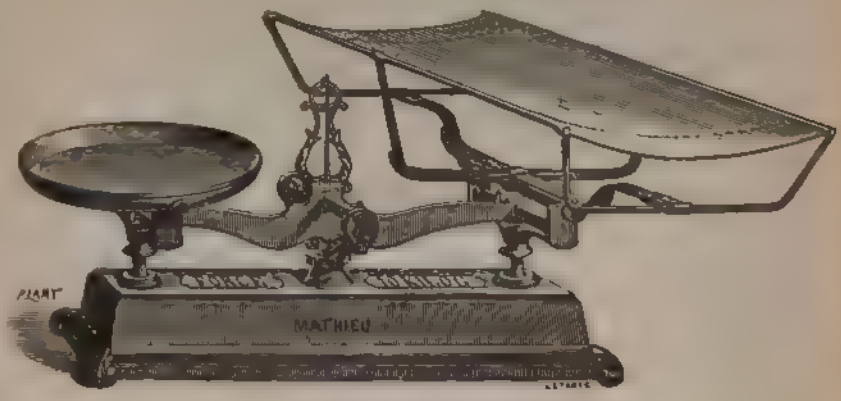


FIG. 4.—Hammock-scales (Pinard).

For weighing newborn children a number of instruments have been invented. Figs. 3, 4, and 5 show those most commonly used.

Fig. 5 shows Galante's baby-weigher, but the scales are to be preferred on account of their greater accuracy.

For registering the infant's weight graphically a ruled

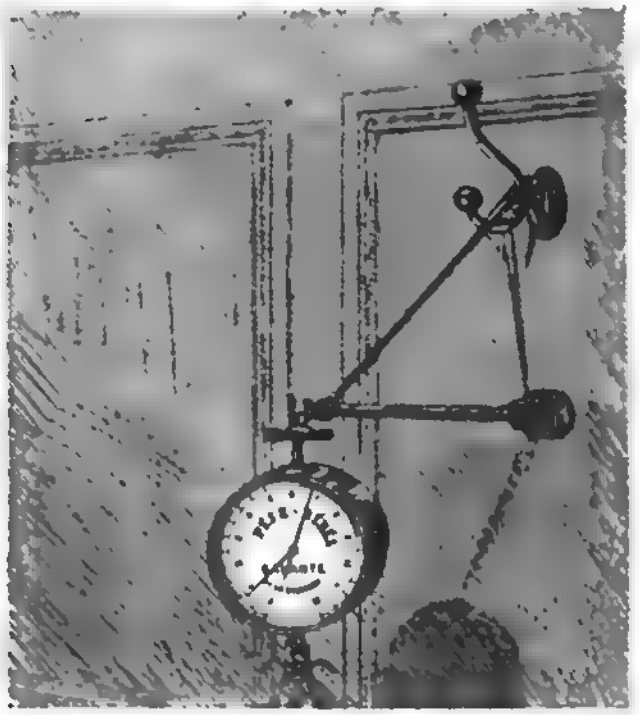


FIG. 3.—Galante's Baby Weigher (the child is hung in a basket upon the hook at the bottom)

sheet of paper can be used, graded according to the days of the month at the top and marked in ounces on the side.

TEMPERATURE—PULSE—RESPIRATION.

The following chart gives the results obtained from five newborn children, and it will be seen that the temperature falls directly after birth, but reascends to its maximum by the evening of the first day, remaining stationary afterward

at 97.5° F. to 98° F. The initial fall is most distinct when the child is born far from its normal term. The pulse averages 120 to the minute; the respiration is very variable.

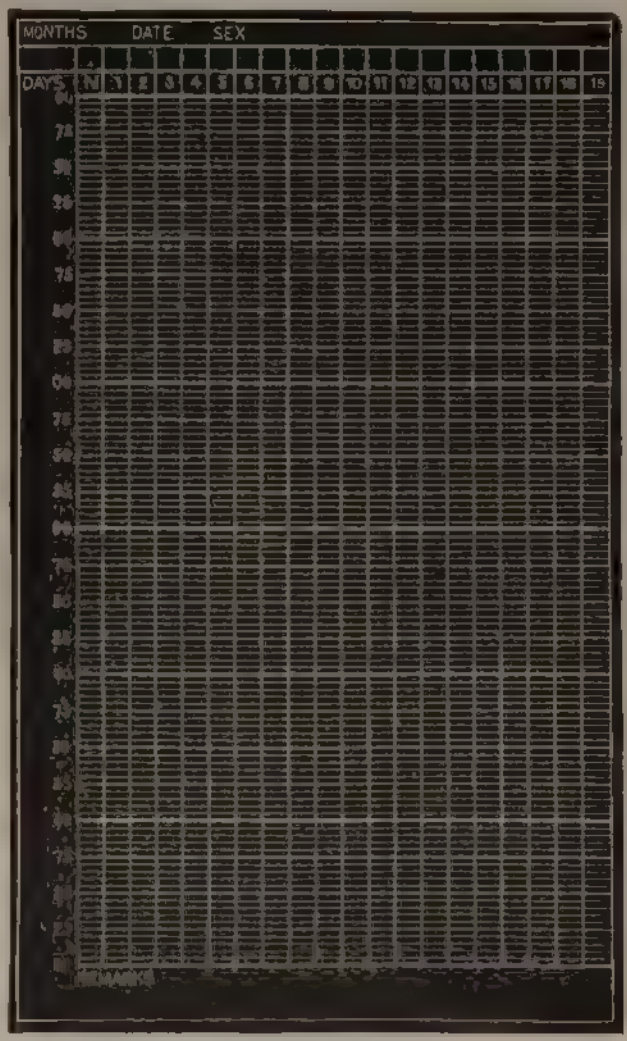


FIG. 6.—Chart for recording the weight graphically (Budin). In the vertical column before the printed figures of units and tenths are marked those indicating the hundredths and thousandths, according to the weight of the infant.

The Cord.

A small piece of fine linen, about six inches square, should be spread with borated vaseline and used to wrap up the cord; this dressing is held in place by a piece of linen about the abdomen and over all a flannel band is fastened. The dressing should be changed every day. Dry treatment of the cord, and, on the other hand, antiseptic dressings with carbolic acid or bichloride of mercury solutions, are disadvantageous; for in the first case the cord becomes harsh and painful, and, in the second, its separation is retarded. Carelessness in the management of the cord exposes the infant to erysipelas of

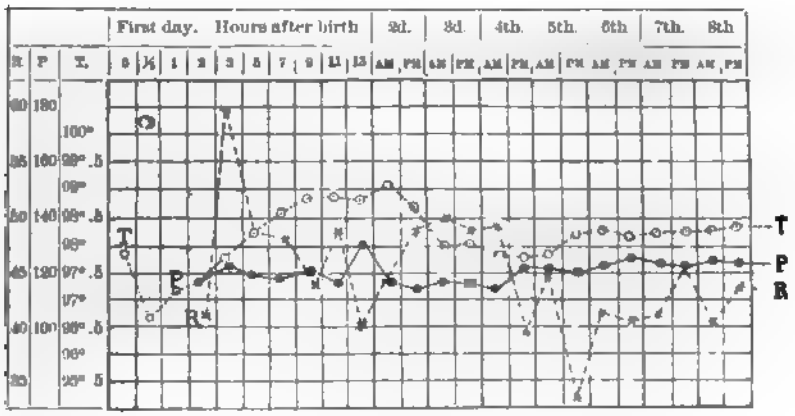


Fig. 7.—Chart of Respiration, Pulse, and Temperature of the newborn child.

the part and umbilical phlebitis, with the possibility of serious consequences—*e.g.*, icterus.

During the first few days after birth the cord dries and shrivels; a vesicle containing serum and pus forms at the umbilicus; and from the third to the sixth day, usually the fourth or fifth, the cord drops off of itself. In weak children, or when moist antiseptic dressings are used, this separation is delayed till the eighth, or even the fifteenth day. At the site of the umbilicus a small ulcerating surface remains for a few days, discharging a few drops of pus; for which a little powdered salol or tannin, or cauterization with nitrate of silver, is all the treatment required.

The Teeth.

The teeth are of two kinds; a deciduous set, which appears first, and a permanent set replacing them.

The deciduous, or "milk," teeth alone interest us here. They are twenty in number, while the permanent are thirty-two. A summary of the appearance of the milk teeth will render the subject more clear and easier to remember.

***Milk Teeth* (20).—The first teeth appear in the following order:**

Middle incisors,	**4**	**in number at**	**6**	**months.**
Lateral incisors,	**4**	**"**	**"**	**9**	**"**
First pre-molars,	**4**	**"**	**"**	**12**	**"**
Canines,	**4**	**"**	**"**	**15**	**"**
Second pre-molars,	**4**	**"**	**"**	**18**	**"**

All the teeth of the upper jaw follow those in the lower jaw which correspond, except in the case of the lateral incisors, where the order is reversed. The eruption of the four middle milk teeth is given in Fig. 8.

Fig. 8.—Order of the Eruption of the Four Milk Incisors.

After the inferior middle incisors appear they are followed by the corresponding teeth of the upper jaw, and, at about the same time, by the superior lateral incisors; but, with this exception, the law holds that the teeth of the lower jaw break through before those of the upper, both for the deciduous and for the permanent set. The dates given above are not mathematically correct, for there are great variations; the first teeth occasionally appear before the first six months, or later than that time, and are sometimes present at birth.

The canines appear often later than the fifteenth month, and it is not rare to have the two pre-molars delayed till the second or third year. The dates I have given, however, are fairly average, are easy to remember, and with this plan of periods of three months the order in which the teeth appear is easily recollected. Schedule of all the teeth, both temporary and permanent:

"Milk" or deciduous (20).—Median incisors.
Lateral incisors.
First pre-molars.
Canines.
Second pre-molars.

Permanent (32).—Infancy teeth—4 in number—the first molars—at the 5th year.

Replacing teeth—20 in number—take the place of the milk teeth, which fall shortly before their eruption.

Childhood teeth—4 in number—appear about the 13th year.

Puberty or wisdom teeth—4 in number—about the 20th year.

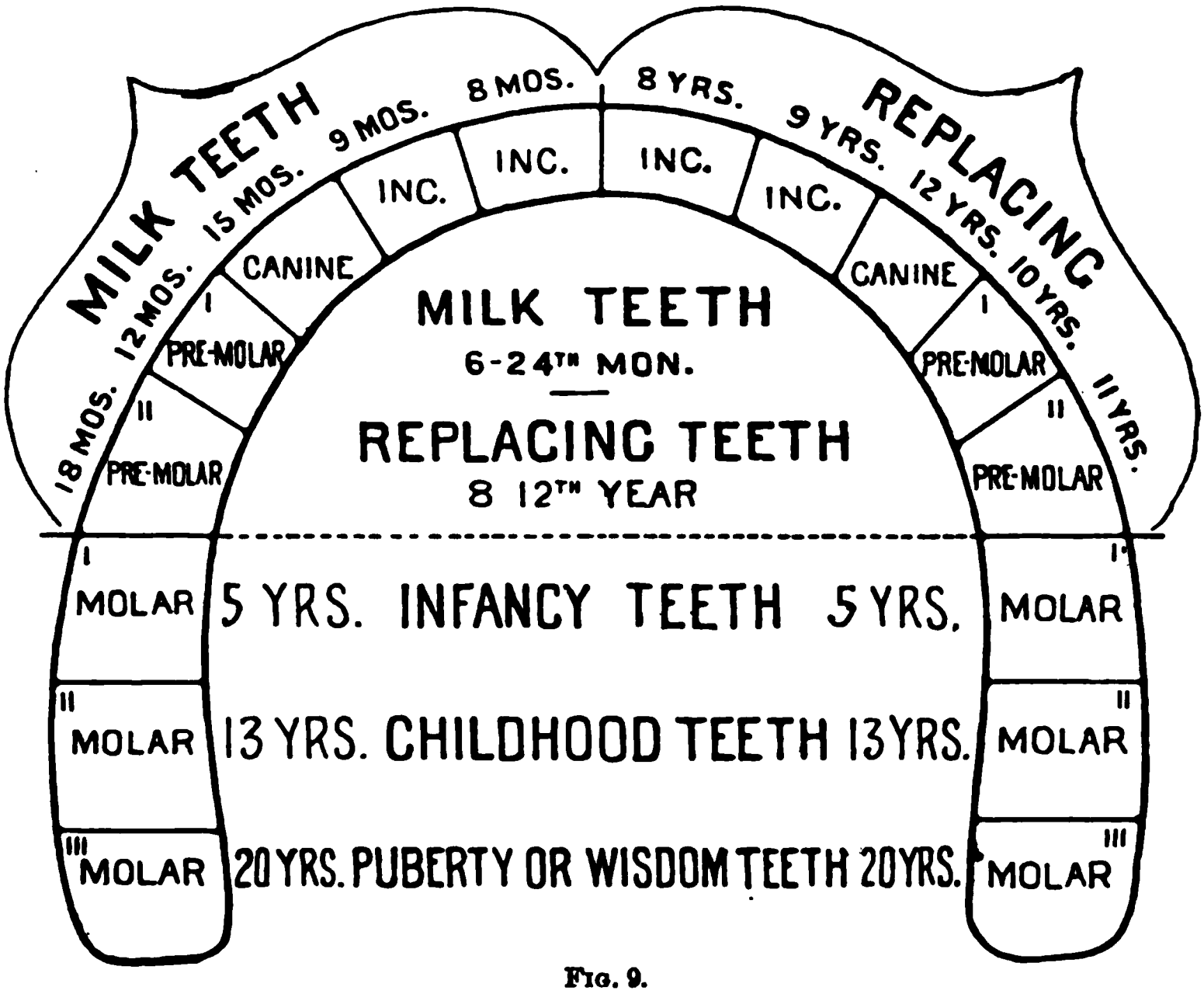


Fig. 9.

The teeth which replace the temporary set come in the following order:

Median incisors at the 8th year.
Lateral incisors " 9th "
First pre-molars " 10th "
Second " " 11th "
Canines " 12th "

The order of their appearance differs a little from that of the first set; for in the permanent set the canines appear after the second pre-molars, and in the temporary set they come after the first pre-molars but before the second.

The milk teeth	come	at	intervals	of 3 months.
The replacing	"	"	"	1 year.
The molar	"	"	"	7 years.

To the eruption of the teeth are ascribed almost all the accidents of the first few years of life, but there is no real foundation for the custom. Diarrhœa and fever, if severe, may induce meningeal congestion and inflammation, but they do not depend wholly upon dentition.[1] If teething is irregular and troublesome, local use of a weak solution of cocaine, or crucial incision of the gums, is quite sufficient to remedy the difficulty. If the eruption of the teeth causes digestive disturbance, it is better not to cease nursing the child as soon as they appear. It is wiser to delay weaning till the first pre-molars, or even till the canines are in place.

Digestion.

The child obtains the milk by a movement of suction, produced by making a partial vacuum with the aid of the tongue in the vault of the palate. After accumulating in the space so prepared, the milk is carried into the stomach and there undergoes digestion by the gastric juice; digestion is continued in the intestine, and, at the same time, active absorption takes place. The dejecta of the newly born pass through three stages. The fæces consist of meconium for the first three days, when the child evacuates what has accumulated in the intestine during fœtal life; a greenish, sirupy material resembling thick poppy juice (μηκων=a poppy). The second stage lasts one day, during which the child's discharges are a mixture of meconium and digested milk. In the third stage—that is, after the fourth day—the stools are light yellow and are formed wholly of the residue of milk after digestion; they have been compared to cooked egg-yolk. In studying malnutrition we shall see that we often find the child's clothes streaked with white or green fæces. Greater frequency in defecation than two to four times a day at first, and than one

to three times after the second month, indicates abnormality and should be considered diarrhœal.

The Skin.

The child passes through three stages as regards its color, each of which lasts three days.

The red stage is marked by bright congestion of the skin, due to the irritant action of air upon a surface not yet accustomed to it.

The yellow stage is a kind of hæmatogenous jaundice, arising from changes in the blood-pigment deposited during the preceding congestion.

In the third, or white stage, the child's color grows paler till the normal rosy tint is established. In the second and third stages the skin is covered by furfuraceous scabs, from epidermal desquamation as a result of the congestion of the first stage, resembling the similar condition in roseola.

CHAPTER III.

HYGIENE.

SIGHT.

THE child's eyes ought to be managed with special care, the doctor in charge examining them at every visit on account of the danger of purulent ophthalmia. The pathology and treatment of this disorder will be considered later. For a short time after birth, children present a slight degree of strabismus which sometimes alarms the family, but it is without importance and disappears as soon as they begin to observe particular objects.

SLEEP—CRYING.

The first period of life is divided betweens leeping, sucking, and squalling. Cries are to be considered normal if not strong and persistent, for the child can neither smile nor talk, as yet, and tears are its only language. But when crying is intense and prolonged it indicates something wrong, and earnest search should be made for the cause—not frequently cold, hunger, or pain from the clothing. To nurse the child, therefore, to warm and to undress it, make a threefold resource applicable to every case. Other causes of continued crying are colic, often the fault of the nurse, and to be relieved by warm poultices to the belly, or dyspnœa, from pulmonary congestion. The nap usually follows nursing and should be taken in the cradle, not in the arms or on the lap of the nurse, for in the cradle the child lies on its side, and if vomiting occur there is less danger of the stomach contents finding their way into the respiratory passages.

DRESS.

The French custom is to provide a hood for the head and a bonnet over that; a flannel shirt and a chemise for the trunk; and a diaper, with cotton or linen coverings for abdomen and

legs, and socks. In England the head is left uncovered, the chest is dressed in an undershirt to which the diaper is fastened by buttons and over this a chemise, and a long dress covers chest, abdomen, and lower limbs. The American dress is similar, but the arms and upper thorax are left bare (?).

Bathing.

It is good to give the infant a warm bath every morning for a few minutes, or, following the English custom, a cool and a warm plunge; when possible this second method should be adopted only during warm weather. During the twenty-four hours from two to four changes of the infant's linen should be made, and each should be followed by the use of starch, lycopodium, or talc powder. These three powders are equally good and serve to keep the parts dry and prevent intertrigo.

Temperature—Incubator.

The newborn child, which has been surrounded in utero by a fluid of warm and equable temperature, is very sensitive

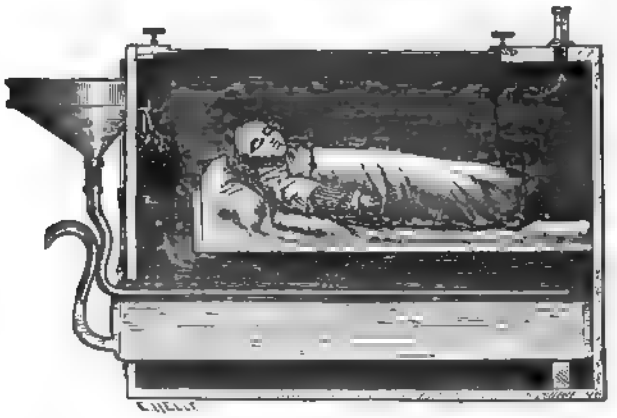


Fig. 10.—Interior of the Incubator.

to variations of heat which it may meet in its new life. Cold affecting the extremities may cause cyanosis and sub-normal temperature, a condition sometimes called œdema of the newborn. Children are particularly sensitive when very young and when prematurely born. To avoid the harshness of changing temperature the child should be kept for a while

where the heat remains stationary at 60°–65° F.; and for this purpose, especially at night, two or three bottles of hot water should be kept in the cradle.

For children born prematurely, or during cold weather, the incubator[3] of Tarnier is very serviceable; of which there are several forms, but the simplest is the best. In 1883 I described a very practical apparatus which is heated by bottles which are changed about every two hours. To avoid this frequent changing, I have adopted a tank[4] which holds ten gallons, and into this about five gallons of hot water are put every four hours; this keeps the child at a constant tempera-

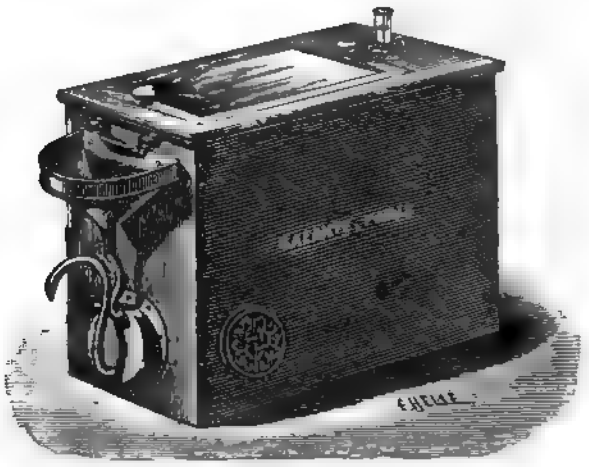


FIG. 11.—Outside view of Incubator.

ture of 86° F. Place the incubator away from all draughts of air during its use, raise it a few inches above the floor by a wooden pedestal, and cover it with several folds of thick cloth. The child is put to bed in the incubator exactly as in a cradle, and directly after nursing, taking care that the temperature of the room is not below 65° F.; the child's toilet and changes may take place in the same temperature. We may leave the infant from fifteen days to a month in this apparatus, and as its vigor increases it may be allowed a little more liberty every day, increasing by an hour daily. It may be wise to keep up the use of the incubator at night for a certain time longer, on account of the great danger of becoming chilled. The incu-

bator may be employed with advantage whenever a newborn child is suffering from external influences, such as cold, or from internal conditions—*e.g.*, premature birth, congenital weakness, cyanosis, œdema neonatorum, malnutrition, etc. During the first weeks it is better than a cradle because the air in it is fresh and of a constant temperature.

Room—Cradle.

The room where the child stays should be ventilated by a chimney and should be kept at 60°–65° F. during the first months. Gradually one can accustom the infant to the ordinary temperature of the room. The child should sleep in a cradle always, and not with mother or nurse, for it has occasionally happened that the infant was smothered by being rolled on during their sleep. While the amount of covering on the cradle must vary with the season, it should never be wholly inclosed for fear of possible asphyxia. The cradle should be in a corner, out of the draught. Certain people insist that the child in the cradle should be turned away from the window to avoid strabismus; this precaution is unimportant.

Open Air.

Children may leave the house during warm weather at the end of eight days; in spring and fall after fifteen days; and in winter after the first month. In cold weather the child should be taken out between 12 M. and 2 P.M., the warmest part of the day; in summer, from 9 to 11 A.M. and from 3 to 5 P.M.

Vaccination.

In time of epidemics the newborn infant should be vaccinated by the end of the second month, on the shoulder or, better, on the back of the calf; two punctures are enough. From the third to the tenth day the child should not leave the house, as it is peculiarly sensitive during the evolution of the vaccine; bathing in the tub should also be omitted. The place of operation may be protected by a dry cloth or a little cotton, and about the eighth or tenth day, when the redness is very marked, a small plaster, or a compress wet with boric acid solution (1 to 25), will allay the local irritation.

CHAPTER IV.

NOURISHMENT.

INFANTS may be fed by the milk of the mother or a wet-nurse; by the milk of animals, directly or indirectly; or by other food, given alone or with milk; and each method deserves separate consideration.

NURSING BY THE MOTHER.

The mammary gland, of which a diagram is given in Fig. 12, is made up of a number of channels (galactophores), which meet in a common point, the nipple, and which end internally in glandular lobules wherein the milk is formed. These lobules are about fifteen in number, as are also the canals leading from them, but the latter, by joining with each other, may reduce the number to ten. The whole structure is rudimentary in man, and, to a less degree, in woman up to the moment of conception. Soon after birth there is a local congestion on the surface of the mamma in the new-born child, the so-called mastitis neonatorum, and this congestion may reappear at puberty. After conception the maternal glands, owing to the hyperæmia of which they are the seat, undergo a proliferation of their elements and a notable development. All the glandular surface is clothed with flat epithelium, whose cells quickly become large and spherical through increase of their contents. The epithelium of the milk-channels is cylindrical.

If at this time the gland be divided through the nipple by a perpendicular plane antero-posteriorly, the appearances given in Fig. 12 will be noted. After leaving the summit of the nipple each milk canal presents a fusiform dilatation, the milk sinus; then it regains its previous size and enters a lobe where it ramifies and sends a branch to each lobule; the lobules are composed of a number of adjoining glandular culs-de-sac.

The canals and the lobes are completely invested by a layer of cellular tissue, much as bottles are wrapped with paper when packed in a case. In the neighborhood of the sinus there is often a small canal which connects with an accessory lobe, or with the sinus itself, and opens upon the areolar aspect of the gland through one of the tubercles of Montgomery (shown at *a* and *b*, Fig. 12). All the tubercles of Montgomery

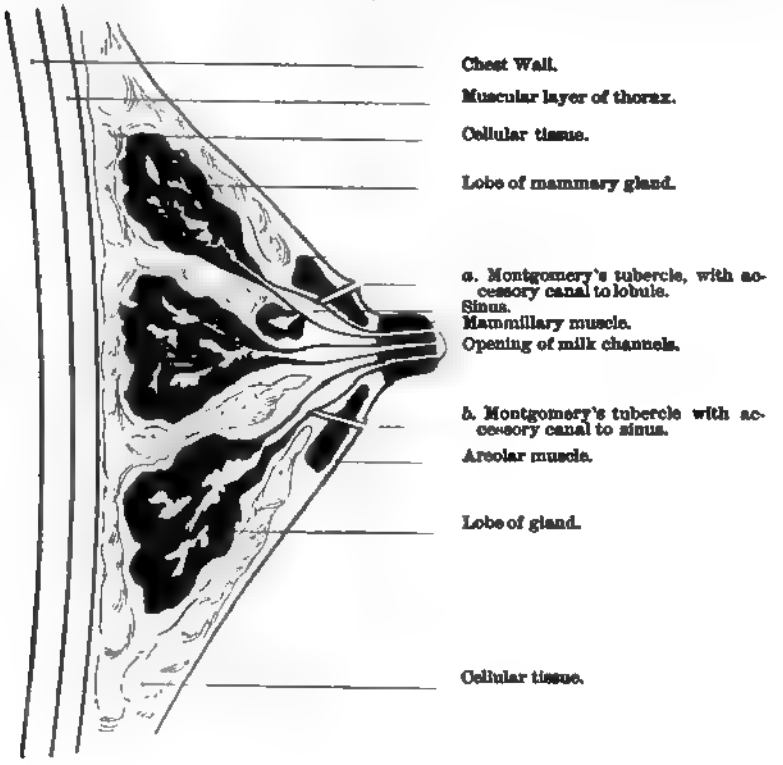


FIG. 12.—Diagram of the Breast.

are provided in this way with milk channels, and slight pressure upon the part during lactation causes the milk to appear at their summits. The galactophores during their transit of the nipple are surrounded by the smooth muscular fibres of the mammillary muscle, which lie in different directions from the base to the summit of the part and form a continuous sphincter. In the areola also we find smooth muscle which acts as a kind of diaphragm, with an opening for the nipple

and its deep surface, parallel with the skin, in close relation to the lactiferous sinuses. This is the areolar, or sub-areolar muscle; by its contraction it tends to compress the sinuses below it.

In these sinuses the fluid secretion of the gland is gathered during the intervals between nursing times. When we wish to express some of the milk, the best way is to seize the circumference of the areola between thumb and index and press gently backward; enough will be thrown out in this way.

The essential rôle in lactation is taken by the epithelium of the lobules, from which both colostrum and milk are formed.

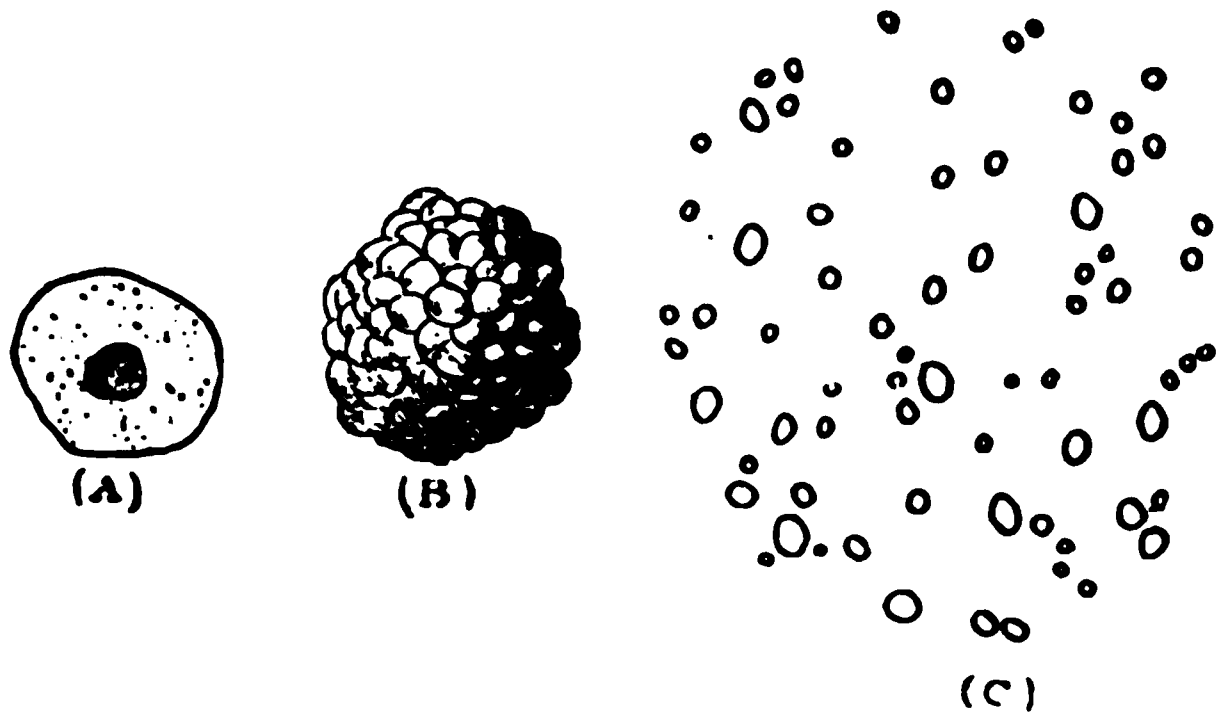


FIG. 13.—A, Epithelial Cell. B, The same, distended. C, The fat drops set free by its rupture.

Milk is composed of gases (carbonic acid, nitrogen, and oxygen), of liquids (water holding milk-sugar, albumin, and different salts in solution), and of solids; the latter are the characteristic elements of the fluid, as the blood-corpuscle is of the blood, and consist of casein and of butter or fat globules. The fat-corpuscles vary from 2 to 20μ in size and are formed from the glandular epithelium in the following way:

(A) The epithelial cell is distended with fat-drops; (B) this continues till they occupy the whole cell and form a mulberry-like mass; (C) this muriform body leaves the glandular lumen, after separating from its wall, and in the milk canal bursts, setting at liberty the globules of which it is composed.

The milk-globules are formed by the destruction of the epithelium; the other elements of the fluid are secreted by the gland wall. Colostrum is formed in a similar way, but it is

more aqueous, and the globules, less highly developed, are again reunited in muriform corpuscles; the explosion which separates them not being repeated.

In pregnancy the mammary gland secretes colostrum alone, as it does also, to a much less degree, at other times; slight pressure will always cause a few drops of light yellow, serous fluid to appear at the nipple.

The secretion of milk is established a few hours after parturition and is preceded by the phenomenon known as *montée du lait.* During the first twelve hours there is intense congestion of the breasts, which become tender and painful; then the milk begins to form and the tension decreases, and if the mother nurses, the function proceeds regularly. There are thus two periods in lactation; the first is congestive and is a preparation for the second or lacteal.

Sometimes lactation is accompanied by languor, headache, rapidity of the pulse, and slight fever; this is the so-called milk fever. But this fever is really a slight degree of septicæmia and has disappeared since the use of antiseptics. "Milk" fever cannot be said to exist. In a normal case there is never any rise of temperature higher than 100° or 100.5° F. During pregnancy two questions must be considered:

1. Can the mother nurse her child?
2. What precautions are needed?

The answer to the first question depends upon general or local considerations. Among the general conditions, almost all chronic diseases, as of heart and kidneys, tuberculosis, anæmia, and extreme weakness, are contra-indications. So likewise are hysteria and too great impressionability, for the lack of nervous control causes irregularities of secretion by which the child may suffer. Among the local conditions which forbid nursing may be mentioned a flat or retracted nipple. The development of the mammary gland and the amount of colostrum are matters for careful thought, for according as the glandular activity is feeble, average, or extreme, the probability is that the woman will make a good, a poor, or a passable nurse. In the matter of local conditions opinion should always be reserved, for the doctor is frequently deceived in his prognosis. As regards our second question, for the last months of pregnancy the nipple should be thoroughly rubbed with brandy, so that it shall be well massaged, to-

gether with its base, and all sebaceous matter removed. During the last five days the nipple should be emptied by the double breast-pump, which prepares it for the child's sucking. These different means are not to be used in the last four weeks, as they sometimes produce premature delivery, but the inconvenience would not be great if it happened within the last thirty days and trifling in the last fifteen.

After delivery, if the mother is not to nurse, she is given a purgative (castor oil or mineral water), and the breasts are covered with a layer of cotton and bandaged toward the middle line, for it is the sagging into the axilla rather than the tension of the gland which is annoying to the woman.

When, however, nursing is allowed, it is regulated in the following manner:

1. *Frequence.*—First day.—One nursing, the child taking the two breasts successively from four to eight hours after delivery.

Second day.—The child should be fed twice from both breasts equally.

Third day (establishment of lactation at the end of the congestive stage, with but little milk).—Nurse three times.

Fourth day.—Begin now to arrange the nursing as follows:

First three months.—Every day nurse at intervals of two hours; at night, from 8 P.M. to 8 A.M., make the interval four hours.

Second three months.—By day, every three hours; at night every six hours.

Third and fourth three months.—By day, every three hours, replacing one meal at the breast by a soup. At night nurse but once, till the child learns to give up even this.

Fifth and sixth three months.—By day feed every three hours, giving two or three other meals than the breast; at night dispense with feeding altogether.

2. *Position of Woman and Child.*—During the first few days the mother should not sit up in bed, but, with the child lying by her side, should turn the breast toward it from which she means to nurse. Before each time the nipple must be washed with warm water, and at the end of nursing with brandy. As soon as the mother can sit up, she takes the child in her arms and, holding it transversely, gives it the breast.

3. *Duration.*—Normally the child should suck from fifteen

to twenty minutes; less than this suggests lack of appetite, and more, lack of milk.

4. *Amount.*—The amount of milk taken is important in two respects, that we may know whether the child drinks enough (with the aid of the scales in doubtful cases), and that we may furnish the right amount when artificial feeding is necessary. Below are the figures for the increase at each nursing and for each day, and as the child is fed ten times in the twenty-four hours after the fourth day, the total amount may be easily found. When the infant nurses less frequently than this, a little ass' or cow's milk should be added to its daily fare:

First day	—	at each nursing	about	f ʒ ij.,	in 24 hours	f ℥ iiss.
Second	"	"	"	f ʒ iv.	"	"	f ℥ v.
Third	"	"	"	f ʒ vi.	"	"	f ℥ viij.
Fourth	"	"	"	f ℥ i.	"	"	f ℥ x.
First month	"	"	"	f ℥ ij.	"	"	f ℥ xx.
Second	"	"	"	f ℥ iiss.	"	"	f ℥ xxv.
Third	"	"	"	f ℥ iij.	"	"	f ℥ xxx.
Fourth	"	"	"	f ℥ iiiss.	"	"	f ℥ xxxv.
Fifth	"	"	"	f ℥ iv.	"	"	f ℥ xl.
Sixth	"	"	"	f ℥ ivss.	"	"	f ℥ xlv.

Seventh month and after about Oiij. a day.

5. *Difficulties and Complications.*—If the nipple is flat or retracted, the child may be unable to grasp it and suction is then impossible.

With a healthy nipple, fissures may be caused by the child's sucking and chewing, especially when no precautions have been observed, and then the annoyance is double. These fissures may bleed, and if the child swallows the blood it appears in its vomit and on its diapers, causing much alarm unless the cause is understood. A fissured or abraded nipple causes great pain to the mother, so that nursing becomes positive torture to her, and, in spite of herself, she is obliged to cease.

Through the entry of microbes, lymphangitis and abscess may occur.

To avoid these annoying difficulties I have invented a breast-pump,[4] which Budin[5] has modified somewhat in the glass, consisting of a dome which fits over the nipple, a long

tube with a nozzle for the mother, a shorter one with a nozzle for the child. The apparatus is held in place by the hand, the mother aspirates gently through the long tube and thus starts the milk flowing into the lower portion of the glass, from

Fig. 14.—Double Aspirating Breast-pump.

which the child sucks it; as soon as the child begins to drink in the milk the mother may stop suction.

One used to hear of a short frænum linguæ as the cause of difficult suction, and it was advised to cut it with the scissors;

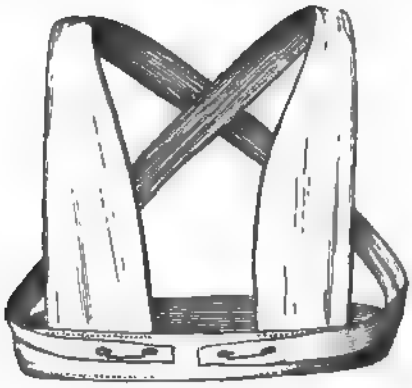


Fig. 15.—Bandage for the Breast.

but the operation is always useless. Thanks to this instrument, which I employ during pregnancy to form the nipple, and in the first days of lactation to lengthen it and prevent fissures, the complications of nursing have considerably diminished and a woman rarely needs to forego nursing her child.

This instrument may be used constantly during the first ten or fifteen days, but then it is given up and not employed again unless there is reason to suspect a new formation of fissures.

In the intervals of nursing, apply a compress wet with alcohol. In case of old and deep fissures, glycerole of tannin and solid nitrate of silver as a caustic, with the use of the breast-pump or even with temporary or permanent cessation, will prove the best treatment.

If there is an abscess of the breast, which is a local manifestation of septicæmia, do not wait for its spontaneous opening, as Gosselin would advise, but as soon as pus is present open

FIG. 16.—Breast Bandage Applied.

the abscess and drain it, wash the cavity frequently with antiseptic solutions, and apply a dressing of borated cotton. Support the breasts by such a bandage as that given in Figs. 15 and 16; this support is very grateful to the patient and more uniform than is obtained by an ordinary simple bandage. Mammary abscess requires that nursing be discontinued for a time or altogether.

Difficulties may arise on the part of the child, either from malformation, as in hare-lip, great feebleness, as in premature birth, or from paresis and apathy. In any case it may be necessary at times to adopt artificial feeding.

6. *Indications for the Cessation of Nursing.*—(*a*) From the mother. Every acute disease of serious nature (like rheu-

matism, typhoid, diphtheria, and the exanthemata) occurring in the course of lactation demands that nursing be discontinued. The infant should be removed if the affection is contagious, and intrusted to a wet-nurse or allowed to try its chances in artificial feeding or from an animal. If the disease is less severe (like gastric disturbance, the grip, or a light attack of septicæmia), nursing may go on or be stopped only for the time.

(*b*) From the child. To decide if the mother suffices to nourish the child, it is enough to consider its daily increase in weight and its discharges; if it gains an average of one-half to three-quarters of an ounce daily, and if its fæces are yellow, the mother is a good nurse and may go on in all safety. When the child gains nothing in weight and its linen is stained with green or loose passages, with perhaps an erythematous eruption, the mother should stop nursing—unless there is decided improvement from the use of lactic acid or Vichy (see malnutrition, p. 219); the food must be changed and a wet-nurse employed. All so-called galactogogue treatment (plasters, heat, faradism) has so questionable an influence that it is useless to try it.

7. *Hygiene during Lactation.*—In addition to ordinary precautions, there are some which specially concern the nursing woman. Her food should consist principally of farinaceous material, but she should avoid all such things as affect the taste of the milk disagreeably, like carrots, onions, asparagus and salads, as they have an unpleasant effect upon the child. As beverages she may use tea and coffee in moderation, wine or beer if she fancies them; but the reputation of beer for increasing the flow of milk is fairly well deserved. Most toxic medicines given to the nurse pass into the milk in varying proportion and become dangerous to the child; chloral hydrate, however, may be given without such fear. The passage of medicine through the milk allows us to treat the infant mediately through the mother, with mercury in syphilis, for example. It is a popular remedy to give the mother rice-water when the child has diarrhœa, and flaxseed tea in the opposite condition.

During lactation, all sexual excitement should be avoided, as every such impression upon the genitals is unfavorable to the mammary secretion, and there is danger of conceiving

again and thus diminishing the milk; it is, however, difficult to suspend coitus entirely. Warm baths may be taken without inconvenience, and the use of cold bathing may be continued if the woman is habituated to it.

The Wet-Nurse.

Wet-nurses are of two kinds; those who live in the family and perform their duties under the eye of the mother, and those who take the child home and nurse it there. The first method is nearly as good as the natural way; the second, with some exceptions, gives but poor results. The choice of the nurse should rest with the doctor, as he alone can decide upon the health of the woman selected.

The examination of the nurse should be held when she is employed, or only a few days beforehand; the custom of examining her when she is pregnant, as is done at times in the country, is unsatisfactory, as it is difficult then to be sure that she will be a good nurse. In Paris wet-nurses are usually found at special agencies, to which they come from the country with their babies to offer their services to doctors and families.

For a new-born child a nurse should be employed who has been delivered within two months or less; for older babies her time and condition should be like the mother's as nearly as possible.

Multiparæ are to be preferred, because they are accustomed to the care of children, their systems are fortified against the fatigue of nursing, and their milk is less likely to vary or to cease prematurely than in the case of primiparæ. If a multiparous woman is chosen, her experience in previous lactation furnishes a valuable guide.

The wet-nurse should be from twenty-five to thirty-five years old, of robust constitution, dark complexion, pleasant and obedient, and possessed of good teeth; her nationality is not important.

Her family history must be carefully ascertained, with special reference to consumption and mental disorders.

As to her personal antecedents, thorough auscultation for tuberculosis and inspection of the throat, the cervical ganglia, the genitals in case of doubt, if she will permit it, for traces of syphilis, should always be practised. Examination of the

heart and the urine furnishes evidence of cardiac or renal disease. It is also wise to assure one's self, by abdominal palpation and vaginal examination, whether involution of the uterus is completely established or whether there is any discharge; but nurses do not as a rule subject themselves to such inspection willingly, and one is often obliged to reject them in consequence.

The child of the nurse should be entirely unclothed and examined, especially about the genito-anal region, for any traces of erythema (a sign of dyspepsia) or of syphilis. Finally, and I end with this on account of its importance, the breasts should be considered, as to size, shape of the nipple, development, and quantity of milk.

Often the doctor is requested by the family to test the nurse's milk by the naked eye or with the aid of microscope, lactometer, etc.; and sometimes they beg him to taste it. These different methods, however taking from their appearance of accuracy, furnish no practical information and it is useless to have recourse to them.

The best standard is the woman herself and also how the child behaves under her nursing; in this way one can estimate the value of the milk most satisfactorily. The nurse once chosen, the child is given into her care and its feeding is managed as already given for the mother. In the case of a newborn infant, it is important that the nurse should completely empty her breast after each nursing; for the infant is not so well grown and does not take so much milk as the woman's own child, and if the surplus is left to stagnate in the breast, the secretion may be hindered or even prevented, a somewhat frequent accident with wet-nurses a few days after they take charge. The diet of the nurse should be such as it was at home where possible, and all excess of eating and drinking, of alcohol and excitement, such as country women are apt to practise in the city, must be prevented. The advice already given for the mother applies also to the nurse and need not be repeated.

Nursing by Animals.

In the country, where it is easily managed, good results have been obtained by letting children suckle a cow or some other animal.

Artificial Feeding.

For this purpose the milk of other animals has been used, but the ass and the cow have been most frequently employed with success; for the milk of the first most closely resembles woman's milk, and that of the second is most easily obtained.

Ass' milk is most useful for weak babies born before term, but as cow's milk is the usual food in artificial feeding, I shall refer only to that in what follows.

To sterilize and keep milk it is well to boil it, especially in hot weather. After boiling the whole amount of milk should be divided among ten or more well-stoppered bottles, each one destined for a single feeding.

Cow's milk it is well to filter and boil, and then, since it is richer than woman's milk, to dilute it with pure water in these proportions:

First month,	milk one part, / water one part,	*i.e.*,	water	one-half.
Second "	milk two parts, / water one part,	"	"	one-third.
Third "	milk three parts, / water one part,	"	"	one-quarter.
Fourth "	and after, pure milk.			

To the water used for dilution it is well to add one coffee-spoonful of powdered sugar to three ounces, for the addition of simple water gives a milk less rich in sugar than the mother's would be.

The child may be fed by cup, spoon, or bottle. With the first it drinks too much at a time; the second is better, but complicated; the third is most commonly used and most convenient. The different forms of nursing-bottle are innumerable; the best is the simplest.

I employ a simple glass tube, furnished with a rubber tube and nozzle. This is adaptable to any shape of bottle and is held fast by a rubber cork.

Ten bottles must be prepared, each holding a little over f ʒ iij., and these are filled with milk early in the day; the dilution is done at the time of filling with water properly boiled and sweetened.

Whatever milk is left in the bottle after nursing is thrown

away, the whole apparatus is then well washed, and it is kept afterward in Vichy or some other alkalized water. It is enough to give the child

f ℥ ij. for the first week or two.
f ℥ iij. " " three months.
f ℥ ivss. to v. for the fourth month and after.

After the fourth month the bottles should be a little larger

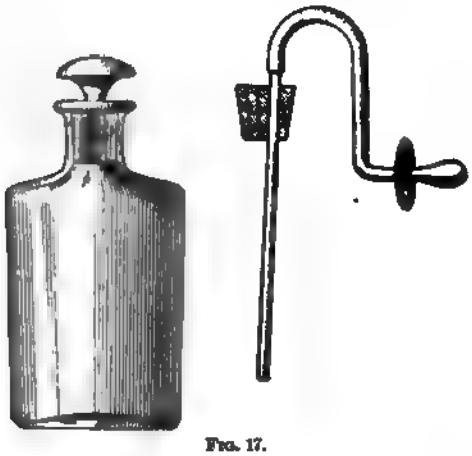


FIG. 17.

than mentioned above; during the first weeks the excess is left in the bottle by the child.

The time and the frequency of nursing is regulated as in natural feeding.

SUBSTITUTES FOR MILK—MIXED FOODS.

The different preparations given instead of milk, or in addition to it, where the quantity is insufficient (mixed nourishment), are:

Condensed milk, a kind of thick syrup made by partial desiccation of milk and needing only the addition of water to reobtain a natural milk (much used in England).

Biedert's and Nestle's infant foods, in which condensed milk is the important element.

Liebig's food, much used in England, in which there is an attempt to combine the chief elements of milk.

Arrow-root, a farinaceous product of India, from the root

of Maranta indica; "racahout," a mixture of cocoa, sugar, vanilla, potáto, and rice starches; sago, from the sago-palm. All these are used in gruels like tapioca. Among other foods, beef-tea, panada, crackers, and toasted bread, and, in fact, most of the soups known to cooks.

All these things cannot take the place of milk, either from a woman or animal, and should not be employed in the first months of life in spite of certain few successful cases where they have been used; but at an advanced age their use may be happily combined with that of milk as a mixed diet, when they are certainly advantageous.

General Directions for Lactation—Weaning.

The whole length of time occupied in nursing is, on an average, eighteen months.

The first half-year: milk. The child should take nothing else, as other food is not well digested and therefore harmful.

The second half-year: starches. From the sixth to the twelfth month, continuing the use of milk, the child may receive a little beef-tea, a cracker, arrow-root, or sago; by trying several, the most desirable can be determined and then given once or twice a day.

The third half year: nitrogenous food. Little by little nitrogenous food may be added to the child's diet, giving, with the milk, soups, eggs, bread soaked in meat-juice, and finely chopped meat.

At the end of eighteen months, sometimes a little earlier, at others a little later, the process of weaning begins. The child is removed from its mother or its nurse, and gentian, aloes, mustard, or some other bitter substance is applied to the nipple to give the child a dislike for the breast. Instead a little sugar-water or a piece of pure sugar may be given. The woman needs only to take an occasional laxative and to lightly compress her breasts by a bandage; other precautions are unnecessary.

[redacted] membrane in the new-
[redacted] and seriously inter-
[redacted] the child cannot breathe with
[redacted] and intestinal revulsion by baths
[redacted] of astringents (sulphate of
[redacted] nitrate of silver, 1:300). Introduc-
[redacted] little glycerole of tannin. Washing out
[redacted] with a rubber
[redacted] TEMPERA-
[redacted] the following
[redacted] premature
[redacted] lowered.
[redacted]
[redacted]
[redacted]
[redacted]
[redacted]
[redacted]

if that be done by another it gives vent to a yellow discharge, which soon re-collects and becomes purulent. Finally the cornea is perforated, the eye empties itself, and the disease ends only when the organ is lost entirely. Then the inflammation subsides and a scar ends the history. There is also a benign form of this disease in which the clinical aspect, and probably the nature of the malady, is very different. Three or four days after birth, without swelling of the lids, one sees yellow muco-purulent accumulations in one or both canthi, the child opens its eyes, and a few washings with antiseptics give relief in six or eight days. The grave form of the disease is produced by the gonococcus (Neisser), inoculated during the passage of the vagina. The nature of the mild form is not yet determined.

Treatment.—Mild form.—Eye-wash of boric acid (1:25) every three hours; possibly cauterization with nitrate of silver.

Grave form.—Preventive.—Remove sources of infection (vaginal douches, isolation of other children with ophthalmia, in the hospital special attendants, etc.). After birth drop a few minims of nitrate of silver (1:50) into the eye and repeat if there is danger of new infection. Curative.—Brushing twice a day with nitrate of silver (1:20 or 1:50); washing every two or three hours (at nursing times) with boric acid (1:25); compresses with hot boric-acid solution (110° F.) during intervals of washing and cauterization.

Mastitis.

A swelling of the breast, like that which accompanies puberty, may occur a short time after birth and possibly lead to suppuration.

Treatment.—Boric-acid compresses. Do not press the gland to extract the contents, as this may cause increased irritation and suppuration. If abscess forms, open with a bistoury.

Impetigo and Eczema.

These affections occur in the scalp and are vulgarly known as "scald-head." A foolish prejudice exists against treatment, for fear of "driving them in" and causing more serious disease.

Treatment.—Remove the crusts by a plaster; follow with

alkaline lotion (sodii bicarb. 1:20) or sulphur water (Enghien or Barèges) or Van Swieten's bichloride of mercury (1:4,000).

Thrush.

This malady is caused by a fungus, the oidium albicans, which occurs most often in the mouth. It comes in white patches along the borders of the tongue or on the inside of the cheeks. Fragments of curdled milk are found in the same situations, but they are not closely adherent and can thus be distinguished. Ulcerative stomatitis is easily recognized by the ulceration. In doubtful cases the miscroscope shows mycelium and spores of the fungus and establishes the diagnosis. When thrush occurs in a healthy child, it is called idiopathic and its gravity is slight; in the course of serious disease it is called symptomatic and the prognosis is grave (*e.g.*, malnutrition).

Treatment.—Wash the parts with borax and rose-water, equal proportions. A teaspoonful of Vichy water at every second nursing alkalizes the digestive tract and prevents the growth of the fungus.

Vomiting.

There are three chief varieties: 1st, the simple rejection by the stomach of the excess of milk in over-feeding; 2d, where milk is not well borne or other food is given and the stomach is irritated; 3d, hæmatemesis. The presence of blood may be due to actual hemorrhage from the alimentary tract, including mouth and stomach, or, most often, to a fissure of the mother's nipple. In the first form, vomiting is physiological and unimportant; in the second it is due to simple indigestion, or, if repeated, to the condition called malnutrition; in the third form prognosis varies with the source of the blood and is good if it comes from the mother, very serious if from the child.

Diarrhœa—Constipation.

Diarrhœa is temporary, from simple indigestion, or chronic, from grave disease of the alimentary canal, and a symptom of malnutrition. Certain forms of diarrhœa are due to special causes, as cholera, which will be described farther on.

Constipation is seldom indicative of serious disease. When well marked, a teaspoonful of syrup of chicory or a pinch of magnesia in the milk, or simple enemata of water or glycerin, or cacao-butter suppositories, will be all the treatment required.

Erythema.

This affection appears usually in red patches about the genito-anal region, and between the thighs (intertrigo). It may occur in healthy children from neglect or from harsh clothing, but most often it accompanies chronic diarrhœa and is found in cases of malnutrition.

Treatment.—Avoid all dampness in the affected parts. Change the child's linen frequently, and cover the diseased skin with equal parts of talc, lycopodium, and bismuth subnitrate. In washing the child do not rub the diseased parts.

Malnutrition.

This term embraces all the changes in an infant when its digestion is seriously disturbed, and presents three stages. In the first, the chief symptom is that the child's linen is covered with white and green fæces instead of the usual homogeneous yellow discharges, and this goes on till entirely green and fluid. The child is restless and fretful, demands the breast too often, and takes too little at each time. If the disease persists, the second stage is reached. The stools are green and very frequent and of a repulsive odor. The child regurgitates or actually vomits its food. The mouth is invaded by thrush, the skin about the anus and the inner side of the thigh is covered with erythema, and this increases the discomfort of the infant. It nurses badly or has no appetite, and in the mouth, besides thrush, we find shallow ulcerations in the vault of the palate. The temperature is normal or one to two degrees above. The child emaciates and gives vent to almost continual sharp cries, indicating its pronounced suffering. The fontanelles decrease in size and the sutures become closer. In the third, fatal stage these symptoms are all aggravated. The appetite is lost, the stools grow less frequent, and there is a false appearance of improvement due to the extinction of all the functions. Respiration is deep and painful, the circulation is retarded, and the temperature falls

as death approaches. The body becomes steadily more emaciated and the skin lies flat upon the skeleton; the face is wrinkled and aged. The child becomes cadaverous and dies in progressive coma, interrupted by occasional convulsions. The course of the disease may be light and chronic or acute and rapid; in the latter case it is specially grave.

Causes.—Predisposing: Congenital feebleness, coryza, syphilis, malformation (*e.g.*, hare-lip). Exciting: Poor nursing, from insufficient quantity of milk because the nurse has too little or because other milk is used, or because the substitutes for milk administered give rise to persistent digestive disturbance.

Treatment.—The best preventive and curative treatment is to provide a good nurse and control the feeding as given above. Next we must relieve the diarrhœa and build up the weakened system. One form of diarrhœa is due to chronic indigestion and is marked by acidity of the stools; for this give alkalies, one or two spoonfuls of Vichy or lime water at each nursing; the other is due to a special bacterium, and the fæces are alkaline. For this give acids, preferably lactic (1:50 of water), by the teaspoonful fifteen minutes after nursing. Complete the treatment by enema of subnitrate of bismuth. For the feebleness employ heat, by bath and incubator. In great depression add a spoonful of fresh beef-tea to the child's diet before each nursing—it must be free from grease—and after each nursing give ten to fifteen drops of old brandy in a little milk. As for premature infants, feeding by the stomach tube gives excellent results in malnutrition.

Cholera Infantum.

There are three varieties of this disease: 1st, the epidemic, or Asiatic; 2d, the sporadic, or simple; 3d, choleriform diarrhœa, which is only a severe form of acute malnutrition. Whatever be the form, the prognosis is nearly always fatal, despite all treatment; nevertheless, warmth in all forms, and the following medication, a teaspoonful every half-hour, should be faithfully tried:

℞ Bismuth. subnitrat., ... ʒ i.
Tr. opii, ... f. ℥ i.
Spts. frumenti, ... f. ℥ ss.
Aq., ... ad f. ℥ iij.
M. Sig. ʒ i. q. ½ h.

Jaundice.

Two forms of icterus are observed in the newborn. The one, hæmatogenous and simple, has been mentioned above (p. 197); it is always benign and occurs to some degree with all infants: the second is due to the presence of bacteria in the umbilical vein, which set up hepatitis and this causes the death of the child. All treatment is needless in the first case and useless in the second, but the second form may be prevented by strict antisepsis of the cord.

Convulsions—Infantile Eclampsia.

Convulsions in the child correspond to syncope in the adult, and their result varies according to their origin. From an etiological standpoint we distinguish two varieties. The first depends upon definite pathological conditions, like meningitis, tumor of the brain, meningeal hemorrhage, pneumonia, eruptive fever, erysipelas, etc. The second form results from temporary causes, such as ingestion of improper food, poisons, intestinal worms, pressure upon a retained testis mistaken for a hernia, etc. This second form I call infantile eclampsia.

In the first class the prognosis and treatment are those of the original disease.

In the second class the prognosis is usually good; the convulsion can be calmed by warm baths or warm cloths, and the cause removed as soon as it is determined.

Sudden Death.

This most frequently follows convulsions, but it may appear with spasm of the glottis, from cerebral congestion, after violent cholera or at the end of syncope; the autopsy may be negative in all points, and we are obliged to suppose a simple cardiac failure whose pathology is vague and obscure.

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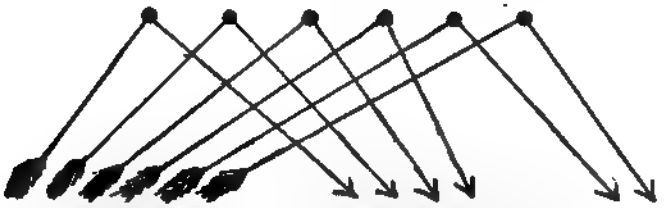
OBSTETRIC CALENDAR FOR CALCULATING THE PROBABLE DAY OF DELIVERY FROM THE LAST MENSTRUATION.



End of Last Menses.							Delivery.									
Jan....		5	10	15	20	25	31	Oct...	10	15	20	25	31	Nov...	1	5	10
Feb...		5	10	15	20	25	28	Nov...	10	15	20	25	30	Dec...	1	5	10
March		5	10	15	20	25	31	Dec...	10	5	20	25	31	Jan...	1	5	10
April..		5	10	15	20	25	30	Jan...	10	15	20	25	31	Feb...	1	5	10
May...	1	5	10	15	20	25	31	Feb...	10	15	20	25	28	March	1	5	10
June..		5	10	15	20	25	30	March	10	15	20	25	31	April..	1	5	10
July ..		5	10	15	20	25	31	April..	10	15	20	25	30	May ..	1	5	10
Aug.. .		5	10	15	20	25	31	May ...	10	15	20	25	3	June..	1	5	10
Sept. .	1	5	10	15	20	25	30	June..	10	15	20	25	30	July ..	1	5	10
Oct....	1	5	10	15	20	25	31	July ..	10	15	20	25	3	Aug...	1	5	10
Nov ...	1	5	0	15	20	25	30	Aug...	0	15	20	25	31	Sept ..	1	5	10
Dec....		5	0	15	20	25	31	Sept ..	10	15	20	25	30	Oct...	1	5	10

Explanation.

This table is divided into two columns, the first referring to the end of the last menstruation, the second to the probable date of delivery. To use the table, find in the first column the date on which menstruation ceased, follow the arrow at the top to the second column, and in this, on a level with the first date, the desired day will be found, that is to say, the period of five days in which delivery will take place. For example, if the last day of menstruation was Feb. 18th, delivery will occur between Nov. 25th and 30th.

THE URINE IN

NEUROTIC DISEASES.

BY

DR. ALEXANDER PEYER.

THE URINE IN NEUROTIC DISEASES.

It is an old-established physiological fact, that all of the secretions may be checked through the influence of the nervous system. If its function is interrupted through division of the nerve fibres, then instantly the secretion is checked, and in the same way in which the will governs the muscular movements, so does the psychological or nervous influence cause the amount of secretion from the ducts to be lessened or entirely checked. In order to illustrate this fact we need only call to mind the effect produced upon the salivary secretions of a hungry person on seeing or smelling food which has an agreeable taste. It is, however, not so well known, that not only the quantity, but also the quality of the secretion is markedly altered by the influence of the nervous system.

This fact is most plainly and most frequently illustrated in the secretion from the kidney, namely, in the case of the urine, and the object of this article, which will be brief, is to give as far as possible a comprehensive survey of the various changes which may occur in human urine as a result of abnormal innervations.

These changes which are the result of nervous influences are often so marked and so striking, that they are frequently mistaken for organic diseases, and often we are scarcely able to determine whether the changes are due to an organic disease or are the result of abnormal nervous influences, or in other words, the result of a neurosis. And yet the differential diagnosis of this condition is often of great practical importance, for the treatment, of necessity, differs markedly according to the cause, in fact, at times should be diametrically opposite.

In speaking of the condition of the urine in neurotic diseases, it is necessary for us to take into consideration not only the quantitative and qualitative changes in the kidneys affected by the disturbances of innervation, but also a special and not less important factor in these neuroses, namely, the different materials which may become mixed with the urine before it is expelled. These admixtures are often the only signs which enable us to make a differential diagnosis of an existing neurosis.

To illustrate this it is necessary to call to mind only the fact of the presence of spermatozoa and of urethral threads in the urine in cases of sexual neurasthenia, etc.

The most frequent functional anomaly in the kidneys is undoubtedly

I. Polyuria.

Every physician has frequently had a patient who expelled a surprisingly large amount of clear, pale urine, he doing so either for a shorter or longer period of time, and owing to the fact that in acute cases the quantity of fluid previously taken had not been unusually large, this condition naturally appeared abnormal to the patient and caused him to speak to his physician regarding it.

On examination, the physician finds the urine normal. It contains neither albumin nor sugar; the specific gravity may possibly be below normal. This examination, in combination with certain other nervous symptoms, enables the physician to make a diagnosis of nervous polyuria (urina spastica, nervosa, diluta).

The patient is reassured on being informed that it is paroxysmal and is merely a symptom of an abnormal nervous condition and is of no importance.

Before entering more deeply into the clinical study of nervous polyuria, we shall cursorily discuss the physiology of the excretion of urine, in order to more readily comprehend the pathological changes.

Bowman (1842) claims that the glomeruli only exude water; that the epithelium in the uriniferous tubules furnish, through their glandular action, the specific ingredients which are taken up by the water which trickles down from the cells.

C. Ludwig (1844) believes that a very dilute urine is discharged into the capsules. This running down through the tubules returns the water by the process of endosmosis to the less watery blood and the lymph of the kidneys and thus becomes normal in consistency. The filtration through the glomerulus depends largely upon the amount of blood-pressure in the renal arteries. If this is elevated, then the filtration occurs more rapidly, and as a result we have polyuria and *vice versa.*

According to R. Heidenhain, the discharge of urine from the kidneys does not depend solely upon the definite physical strength, but that besides a number of well-known facts, the active vital forces of special secretory cells, are also important factors. What this latter and evidently fundamental physical strength is, has as yet not been ascertained. Consequently the amount of urine does not depend solely upon the blood-pressure in the course of the renal arteries and therefore does not come strictly under the law of filtration, for the cells covering the glomerulus also take a very active part. This vital action of the glandular cells is the cause of our being unable to recognize in the glandular tubules any simple physical apparatus.

As far as the influence of the nerves upon the renal secretion is concerned, the effect of the vaso-motor nerves upon the discharge of urine has become well known and positively determined.

The renal nerve—that is, the vaso-motor nerve of the kidney—is the splanchnic; irritation thereof causes a diminution in the calibre of the renal arteries and a blocking of the urinary discharge, even if the pressure in the aorta is elevated; if the nerve is divided, or if the sympathetic is irritated, then polyuria results.

The normal amount of urine passed by a healthy adult during the twenty-four hours is a little over three pints and has a specific gravity of 1.020. J. Vogel claims that two and one-fifth pounds of bodily weight furnish fifteen minims of urine. It is, however, better to place the physiological limit of the amount of urine discharged at between two and a half and four and a quarter pints. If the quantity discharged during the twenty-four hours exceeds this given amount to any great extent, then the condition is called polyuria. Ac-

cording to different authors, the quantity of urine discharged has been observed to be as much as forty-seven and a half quarts per day.

Patients having polyuria who consume the same amount of fluid as does a healthy person, pass more urine and of lower specific gravity than does the healthy person during the same period of time, and the amount of insensible perspiration is much less in these people than it is in a healthy person.

The clinical symptoms of polyuria are very varied. The rule, however, is, that no matter what the symptoms, the urine is voided without any difficulty.

From the clinical symptoms we are enabled to classify nervous polyuria into two groups, the acute and the chronic form.

In the acute form the polyuria only occurs on certain days and then only once a day. The patient voids from two and a half to about five pints of urine in an hour. Generally at this time there are other nervous symptoms. One of my patients—*e.g.*, a neurasthenic professor of philology thirty-two years of age—awoke in the morning feeling indisposed, but what attracted his attention the most was a peculiar abnormal sensation in his abdomen. He felt unusually tired and listless, and in half an hour's time passed about four and a quarter pints of urine, clear as water. He had not taken a large amount of liquid the night before. During the remainder of the day the amount of urine passed was normal, as usual.

In other cases the polyuria may last for a number of days and then suddenly disappear for a time. I recollect the case of a young Catholic priest who was treated by me for spermatorrhœa and marked irritability of the nervous system.

Besides numerous other things in regard to his illness, he related the following: The amount of urine which I discharge varies greatly; sometimes I pass a great deal and then again for a time I pass only a very small quantity. I would like to relate to you as an example of this the following fact, namely, that during the investiture of my brother as priest, I became much excited during the ceremonies. I had a painful and tired feeling in the sacral region and down the thighs, but what troubled me the most was an intense desire to urinate, so that during forty-eight hours I was compelled to pass water hourly during the day and four or five times during the night.

The urine was clear as water and the quantity enormous, although I had not taken an unusually large amount of fluid.

The acute may also only occur at a certain hour of the day. A student—Mr. N., *e.g.*—passed a large chamberful of clear urine immediately on rising in the morning. During this time he experienced a cramp-like condition of the entire body, which compelled him to continually stretch himself and strain.

In the chronic form the polyuria may last for months and years, the condition remaining about the same.

If the specific gravity of this large amount of urine is not diminished in chronic polyuria and if there is an increased amount of the solid constituents, then the condition is known as diabetes insipidus. This condition is frequently accompanied by an abnormal feeling of thirst—polydipsia.

The causes of polyuria are the following:

1. Psychical influences (sorrow, cares, worry, excitement, fright, etc.). Even the laity understand that these are frequently the causes of urina spastica.

A typical example of this is furnished in the case of the Catholic priest which has already been cited, who during the investiture of his brother was compelled to pass an enormous quantity of urine for a number of days. Usually, however, the polyuria which results from these causes is acute and only lasts a few hours or a few days.

2. Hysteria and neurasthenia are important factors as regards the causation of nervous polyuria. Since patients of this description show symptoms dependent upon a perverse reaction of the nervous system, we may attribute the polyuria to be the result of a paresis of the splanchnics.

3. In a similar manner, as in cases of hysterical convulsions, in chorea and in epileptoid conditions and at the termination of an attack of migraine, we notice the discharge of an increased amount of urine. The cause is evidently a nervous one and is especially to be sought for in a dilatation of the renal artery, which is probably produced by an irritation of the splanchnic, this originating in the medulla at the beginning of the attack (Salkowski and Leube, "Die Lehre vom Harn").

4. Anatomical changes in the central nervous system also undoubtedly represent a large number of the cases which

cause nervous polyuria. In diseases of the medulla, the cerebellum, and the spinal cord, polyuria is one of the main symptoms, and this condition frequently occurs as the result of injuries to the skull and concussion of the brain. It is well known that in injuries to the floor of the fourth ventricle (Piquure of Cl. Bernard) polyuria may be the only result.

Kohler ("Wiener medicinische Blätter," 1885) showed experimentally that by producing a circumscribed injury to the medulla in rabbits we can cause a permanent polyuria; whereas Bennett ("Brit. Med. Jour.," Feb. 24th, 1884) published five cases of cerebral disease in which polyuria existed, and in every case the medulla was found to be normal.

Demme ("XVI. Jahresbericht des Jenner'schen Kinderspital in Bern") relates a case of diabetes insipidus in a boy six years old, who complained first of fever and occipital pain, followed by great thirst and the discharge of a large amount of urine, the total amount being about fifteen quarts in the twenty-four hours. Owing to the fact that there existed a thickening upon the right tibia and that the glands were swollen, inunctions were prescribed, whereupon all the symptoms, including the polyuria, disappeared. Demme believed that there existed in this case a gummy new-formation in the floor of the fourth ventricle.

Hösslein ("Deutsches Arch. f. Klin. Med.," Bd. 37) also described a case of an adult with diabetes insipidus, following cerebral syphilis. A cure was effected by employing antisyphilitic treatment.

Axel Johannesen ("Norsk Mag. f. Lägevidensk.," 3 R. XV. 7, S. 401, 1885) saw a case of polyuria due to the bite of an acarus (Ixodes ricinus) in a boy of eleven, in whose family nervous and mental diseases were prevalent. The bite was in the vicinity of the external occipital protuberance and was followed by headache, delirium, and facial paralysis. At the same time marked polyuria set in, this disappearing entirely after ten days. According to the views of the author, there occurred a neuritis of the accessorius as a result of the bite of the acarus, which extended centripetally toward the medulla and caused the polyuria.

In cases of cerebral tuberculosis it is not uncommon to find diabetes insipidus. Hagenbach described the case of a girl four and a half years of age, who in twenty-four hours passed twenty-one pints of urine.

Polyuria is not infrequently found to be present in cases of Basedow's disease, which disease, according to the experiments of Filehne, depends most likely upon an affection of a certain nervous centre in the medulla.

Diseases of the urinary and genital organs not infrequently cause a nervous polyuria by reflex action.

Ultzmann cites the case of a woman twenty-seven years old, who on an average passed forty-two pints of urine daily. The cold-water treatment, preparations of arsenic and the bromides had no effect, whereas local treatment, applied to the existing chronic endometritis from which she was suffering, cured the polyuria in a short time.

Dr. Handfield Jones observed the case of a boy suffering with an irritable bladder and polyuria, and believed the former condition to be the cause of the marked increase in the amount of urine discharged. He explains this by the fact that the hyperæsthesia of the bladder extended upward to the renal nerves and thus produced a polyuria.

6. In some families, however, the disease is congenital and hereditary.

Weil ("Virch. Archiv," Bd. 95) gives the history of a family in which a man developed diabetes insipidus at eighty-three, he having ninety direct descendants, of which three children, seven grandchildren, and twelve great-grandchildren inherited the disease, while the sixty-eight remaining members were free from the affection. A positive cause could not be discovered.

Concerning the frequency of polyuria as regards sex, I am unable to make any positive statements. It would appear, however, that there is no great difference. There is more likelihood to be a difference as regards age.

Patients may be found with this affection at almost all ages. In cases of irritable bladder, for instance, it occurs between the ages of eighteen and forty-five, which is most probably due to the fact that the most important events in our lives occur betwen these years. In the beginning of this period we have the results of sexual abuse, namely, onanism, as an important factor. Furthermore, at this age those external influences which produce neurasthenic conditions play an important part, especially sexual intercourse, severe bodily and mental exertions, excitement, sorrow, cares, etc., and in women uterine diseases.

In making a diagnosis of nervous polyuria we must first of all consider the condition of the nervous centres, namely, the brain and spinal cord, and then the function of the entire nervous system. Furthermore, we must exclude a number of organic affections of the kidneys and bladder, under which conditions there may be the discharge of an increased amount of urine.

In making a differential diagnosis we must exclude in the first place diabetes mellitus. This differentiation is easy if we ascertain the specific gravity and the presence of sugar.

We differentiate this condition from the contracted kidney, in which condition there may also be an increased amount of urine, by the presence of a few casts, albumin, and the existence of cardiac hypertrophy.

In differentiating from chronic pyelitis in which the amount of urine is almost double the normal quantity, this, in fact, being a pathognomonic sign, we discover pyuria and albumin in the latter, and the amount of albumin is greater than would be accounted for by the pyuria.

As regards diseases of the bladder, we must consider the irritable bladder. I have often been able to differentiate between polyuria and irritable bladder, for not infrequently the patients with irritable bladders believe that they have urinated a large quantity. Under these circumstances the simplest method is to have the patient measure the amount passed during the twenty-four hours, and having him do so frequently.

This same plan can be adopted in cases of marked dilatation of the walls of the bladder, which is the result of retention of a large quantity of residual urine—*e.g.*, in cases of hypertrophied prostate. Owing to the fact that the patient has a strong desire to urinate in these cases and does urinate frequently, especially at night, he naturally believes that he has polyuria.

The best method of making a differential diagnosis in these cases is by the use of the catheter.

Finally, we must differentiate between polydipsia and polyuria.

As a rule, the polyuria is primary and the polydipsia is secondary in diabetes insipidus; but there have undoubtedly been cases in which the thirst preceded the increase in the quantity of urine discharged, and although primary polydipsia

is exceedingly rare, in fact doubted by some, still Professor Worm-Müller ("Norsk Mag. f. Lägevidensk," 3 R., IX. 4, Z. 367, 1879) does not appear to be in error in classifying the symptoms of a case under this heading. Kaurin also believes that this condition may exist. Since the results of observations prove that there are cases of diabetes insipidus in which polydipsia is the first symptom, consequently Worm-Müller considers it necessary to make a marked distinction between cases of diabetes insipidus with primary polydipsia and those with primary polyuria.

Polydipsia may exist independently of polyuria and *vice versâ*. Both occur as diseases *sui generis* and as secondary symptoms of other diseases. If they are to be considered as symptoms, then, according to Worm-Müller, there must be a disproportion between them.

Nothnagel ("Durst und Polydipsia," V. A., Bd. 86) believes that in diabetes insipidus the polydipsia is the primary and the polyuria the secondary condition, and cites the case of a healthy man, thirty-five years old, who had a fall and received a contusion over his occiput, this being immediately followed by intense thirst, and although he consumed thirty-nine pints of fluid during twenty-four hours, still the amount of urine discharged during these twenty-four hours was only twenty-eight and a half pints. Nothnagel believed that in this case there was an excitation of the thirst centre, without, however, involving the centre for the discharge of urine, and he believes that the thirst centre lies in the medulla or in the pons, because we also find the centre for respiration here.

II. Anuria and Oliguria.

Under this heading we include the various conditions of the uropoetic system, in which either no urine a tall or else only a small quantity enters the bladder. This condition is due to the fact that the arterial supply to the kidney is partly or entirely shut off, or else due to the fact that the urine which has been formed cannot escape from the kidney. The first form is usually the result of diminished rapidity of circulation and of diminished blood-pressure in the vessels; this condition is also observed as the result of a purely nervous condition. The blood supply into the glomerulus of the kidney may be

interfered with owing to purely nervous causes, since by irritating the splanchnic we cause a contraction of the renal arteries. Consequently we may have a nervous form of anuria or oliguria, as may be occasionally seen in hysteria and neurasthenia.

Ultzmann observed two cases of oliguria in hysterical women. In both cases he could obtain only an extremely small quantity of urine on catheterizing the bladder.

Benedikt claims to have seen a hysterical woman with anuria, this condition lasting eight days. I treated a case sent to me by a colleague from the country, the patient being a very hysterical woman and with a retroflexed uterus. Frequently the woman went for two or three days without passing a drop of urine, and felt no desire whatever to do so. Then the urine which she passed at a time would amount to about five to six ounces and had a specific gravity of 1.018. The urine became cloudy as soon as passed, owing to the presence of uric acid salts. The urine always showed traces of albumin. By replacing the uterus, this functional neurosis of the kidneys disappeared.

Another case, which was due to spermatorrhœa, I described in the chapter on nervous melituria.

According to Denian the seat of hysterical anuria is in the medulla oblongata, and through functional irritation a contraction of the renal vessels is effected and thus the urinary secretion ceases. Charcot also believes in the purely nervous origin of anuria. Owing to the fact that in marked cases of oliguria the urinary constituents which are discharged with the urine are not relatively diminished, consequently Charcot very properly draws the conclusion that the hysterical oliguria cannot be caused by a cramp-like condition of the ureter, because according to M. Hermann's experiments the diminution in the discharge of urine in cases of occlusion of the ureter is accompanied not only by an absolute, but also by a relative, diminution in the amount of the urinary constituents.

According to this, it is most likely in hysterical oliguria, just as in nervous polyuria, that the renal nerves become affected, this being especially due to an irritation of the splanchnic, and furthermore, when the anuria lasts a long while, there may be a paretic condition which originates in the cervical portion of the cord and which also has some bearing upon the existing conditions.

Under this heading we must also include toxic anuria, *e.g.*, cases of lead colic in which the poison produces an abnormal irritation of the splanchnic, and this in turn produces a contraction of the renal arteries.

Cohnheim considers the oliguria in cases of puerperal convulsions to be dependent on a cramp-like condition of the renal arteries, because there are no anatomical causes for the stasis which results from oliguria which can be attributed to the pregnant uterus.

The sympathetic anuria occurring in a healthy kidney in cases in which the other kidney has been injured must also be included under this heading. This condition, which is not at all a rare one, may be the sole cause of death, as *e.g.*, in cases of extirpation of one kidney.

We have to differentiate these nervous varieties of anuria and oliguria from the following conditions:

1. From those cases of anuria or oliguria which we frequently meet with at the commencement of a diffuse nephritis. In severe cases the anuria may last for a number of days. The existing fever, the presence of albumin, blood-corpuscles, leucocytes, and casts in the urine will suffice in order to make a differential diagnosis.

2. The oliguria or anuria which results from a sudden plugging of both ureters as a result of the presence of renal calculi in the urinary passages, or due to a bending or twisting of the ureters in cases of movable kidneys. These can be easily differentiated from the nervous form.

3. The anuria resulting from a blocking up of the ureter at the point where it enters the bladder, when due to tumors, is readily diagnosticated by means of the existing bladder symptoms.

III. Nervous Albuminuria.

There is no pathological condition of the urine which is of more practical importance to the physician than the presence of albumin, for in the majority of cases its presence is the symptom of serious changes in the uropoetic system, and until a short time ago every case of albuminuria, no matter how slight, was considered as an indication of a serious pathological condition, namely, a symptom of an organic lesion of the

kidneys and of the other urinary organs. Only in recent times has it been demonstrated that not infrequently there are exceptions to this rule, in which in perfectly healthy persons small quantities of albumin have been discovered in the urine, but more than this, albumin was found not infrequently to be present in cases of neuroses where there existed no lesion either of the urine-forming or urine-discharging organs.

In order to comprehend those conditions in which albumin appears in the urine, we must again consider the general physiological rules. As has already been demonstrated, the solid constituents of the urine are drawn from the surrounding lymph through the activity of the epithelium of the uriniferous tubules, especially in the curved ones, and are given off into the fluid of the uriniferous tubules. The discharge of serum-albumin is retarded in all probability by the membranes of the vessels—that is, by the epithelium thereof. As soon as the rapidity of the circulation in the renal arteries become so slight, let the cause be what it may, that the addition of carbonated arterial blood no longer nourishes the glomerulus epithelium, then the immediate result is the discharge of albumin from the blood. This is directly due to a diminution in the amount of blood passing through the arteries, and this condition may also be brought about through nervous influences. Cl. Bernard and others have demonstrated the fact that a lesion of various portions of the brain and spinal cord and irritation of the renal nerves produce a discharge of albumin into the urine. The changes in the condition of the circulation produced by these lesions play an important part in the formation of albumin, and may be directly attributed to a narrowing of the renal arteries, which depends upon a general sinking of the arterial pressure and a slackening of the circulation in the glomerulus.

Consequently we find albumin, 1, in all diseases of the brain and spinal cord. 2. In general neuroses, epilepsy, tetanus, and in cases of lead colic. 3. In diseases of the genital organs.

Under this category we include the case which I described under the heading anuria and oliguria, in which there was always a small quantity of albumin in the urine.

Ultzmann ("Vorlesungen über Krankheiten der Harnorgane") also claims that we occasionally find cases of renal al-

buminuria which are sympathetic symptoms of diseases of the bladder and prostate gland.

4. Depressing mental conditions have a decided effect in producing a transient albuminuria, as has been demonstrated by Dukes, Ultzmann, and Fürbringer.

5. Henoch ("Kinderkrankheiten") observed cases in which this occurred, the urine being loaded with urates, this condition reminding one of cases of renal colic in the adult. In the cases of two children, respectively three and four years of age, the pains were occasionally located in the abdomen and were accompanied by chills and fever, which lasted for a number of hours and each time were followed by the secretion of a cloudy urine, rich in urates and containing albumin, whereas in the intervals, which frequently lasted for months, the patients remained perfectly well and the urine was normal.

Excretion of true gravel, which both in adults and children may produce inflammatory processes in the pelvis of the kidney as well as in the parenchyma, has never been observed. The discharge of albumin during the attacks of pain may be attributed to an altered innervation of the kidneys.

IV. Nervous Melituria.

Since in healthy persons there is sugar in the blood, without any regard to the kind of nourishment, consequently it is not strange that normal urine may contain a minimum amount of sugar, but not necessarily, especially if we remember the fact that sugar is so readily filtered. If the nourishment taken is very rich in sugar a melituria may result, which, however, is still within physiological limits. This fact was proven by Blot in cases of pregnancy and nurslings. It has been experimentally demonstrated (especially by Piquure Cl. Bernard) that the nervous system has a very great influence over the amount of sugar discharged by the urine. Melituria may be produced through lesions other than by injury of the fourth ventricle, these lesions being situated in other portions of the central nervous system, and also by division of different portions of the sympathetic.

The experiments of Cyon and Aladoff have proven that the melituria is due to the action of the vaso-motor nerves and depends particularly upon the comparative amount of blood-

pressure in the liver. As a matter of fact, many causes may act together in producing melituria, causing a diminution in the blood-pressure and a dilatation of definite arterial plexuses, and as a consequence we have an acceleration of the circulation.

We not infrequently find sugar in small quantities in the urine of individuals who suffer with neuroses. It is also not uncommon to find sugar in chronic diseases of the brain and spinal cord. It may likewise be found as a temporary condition where there has been a concussion of the brain; in a number of cases, a glycosuria which lasted for days and weeks has been observed to follow violent mental emotions. As early as the year 1863 Guido Baccelli published the results of a clinical study to prove the theory of the neuropathic origin of diabetes.

As causes of nervous melituria the following may also be given: Diseases—that is, irritative conditions of the male or female genital organs (Blau, "Ueber Diabetes:" Schmidt's Jahrbücher, Jahrg. 1884, Nr. 11, Band 204). Of nine cases of diabetes in women Löb found five with diseases of the sexual organs, these conditions existing before there was any sugar in the urine, and the conditions were respectively retroflexion and fibroids of the uterus, and in two cases prolapse. In addition to this, there are a number of cases reported in which diabetes appeared during pregnancy or in the puerperal condition, and in one case the diabetes existed in connection with an ovarian tumor. Accordingly Löb believes it possible that irritative conditions of the sexual organs may produce diabetes by reflex action, and more especially is this the case when there is a hereditary tendency existing in addition. He recommends frequent examination of the urine for sugar in all cases of uterine disease. On the other hand, it is also very important to carefully watch every affection of the genital organs in women and girls in whose families diabetes exists.

It is a well-known fact that onanism may be the cause of diabetes in the male. In a case of Yarrows, a man of middle age, the cause appeared to be a constant excitation of the sexual organs without the desire having been satisfied. The symptoms in this case were a frequent desire to urinate, associated with pains in the back of the head and in the lumbar region. The treatment consisted of the internal administra-

tion of the bromide of ammonium and fl. ext. of jaborandi, and counter-irritation to the back of the neck and over the lumbar region. A cure was effected in eight days, and just before the sugar disappeared a pollution occurred. Ultzmann also observed one case in which there were two per cent of sugar, for a time, in the urine, the patient being impotent and suffering from general reflex irritability.

Melituria has frequently been observed (Eulenburg and Guttmann, "Pathologie des Sympathicus," Berlin, 1873, S. 194) in cases of peripheral nervous affections. Professor Rumo tried to prove, as the result of many observations, the existence of nervous glycosuria.

Since melituria may be artificially produced in animals by division of the sciatic nerve, consequently the nervous origin of melituria of this variety has been experimentally demonstrated.

In conclusion, I cite a case which occurred in my practice, which appeared to me to be typical of nervous melituria:

Mr. A., a merchant, thirty-six years of age, of medium size, with only a fair amount of muscular development, returned to Europe a short time ago, after having been in India for fifteen years. His return was due to the fact that he was troubled with an affection of the skin which would appear for a time and then disappear again. The clinical history of the case was as follows: With the exception of the usual diseases of infancy and childhood Mr. A. had always been well up to his twenty-third year. At this age he developed a gonorrhœa, this disappearing at the end of six weeks. He married at 28. Up to the time of writing his wife had borne him three children. At 30 he had an inflammation of the bladder (?) which was treated by the use of ice and was cured in a short time. Two years later he had an attack of dysentery, this lasting three weeks, and at the same time a slight diphtheritic sore-throat. These affections were followed by a condition of great nervous irritability, and the patient has been troubled with this ever since. During the year just mentioned, there appeared an eruption upon the skin; the nature of this eruption was not diagnosticated by the physicians in Bahia. There appeared at first small vesicles, which became larger, and then they would burst. The use of a sulphur bath had little

effect, but arsenic caused a rapid improvement. The physicians and the patient himself believed that the cold feet which he always had, even in the hot season, was a result of the diphtheria and dysentery. His feet would frequently go to sleep, and often he was unable to feel the floor when walking. The pulse was much more rapid than normal, even when the patient was perfectly quiet. Cohabitation produced a marked rapidity of heart's action. It would make him feel as if he were going to have an apoplectic stroke. The following year the eruption reappeared, and at the same time the patient noticed that he was only passing a small quantity of urine, usually urinating but once in the twenty-four hours and then only a small quantity. Owing to the fact that the eruption was constantly reappearing in spite of the use of arsenic, the patient determined to return to Europe. On board the ship the eruption disappeared of its own accord and only reappeared at intervals upon the eyelids. In Vienna, a specialist on diseases of the skin called the case one of chronic pemphigus and recommended the Carlsbad cure. At Carlsbad, for the first time, a moderate amount of sugar was discovered in the urine, this entirely disappearing after a cure of some weeks. In April, 1881, the patient came to me to be treated for sexual functional anomalies. Mr. A. stated that for some years past his sexual desire had been markedly diminished and at times had disappeared entirely. The same condition existed as regards seminal emissions. He seldom had erections. When attempting intercourse the ejaculation was precipitous and almost without any feeling whatever, but at the time, as stated before, he had violent cardiac palpitation.

An examination of the urine showed distinct evidences of the presence of sugar. Furthermore, there existed a moderate degree of spermatorrhœa and in the urine were found large numbers of urethral threads.

My diagnosis was posterior urethritis following gonorrhœa and also possibly masturbation during youth. The impotence and the nervous symptoms (cardiac palpitation, etc.) we considered as dependent upon this condition. That the melituria had anything to do with his sexual troubles, I could scarcely take for granted.

Energetic local treatment caused an improvement of the sexual condition, to the complete satisfaction of the patient,

and the sugar has not reappeared in the urine since, although the patient has returned to India, where he remained for a long period of time.

V. Nervous Choluria.

If a large quantity of bile passes into the blood, no matter what the cause may be, then the coloring matter of the bile enters the urine as do the biliary salts—choluria. The most common cause of this condition is the stasis of the bile in the lymph channels and in the blood, owing to some interference with the discharge of bile. This is called resorption icterus. There may also be a suppression icterus, or, as it is called by Harley in his work on diseases of the liver, icterus of enervation. Although the liver must be considered only an organ of secretion, still, in a limited sense, it acts as an excretory organ for the biliary constituents; for the latter, as they are reabsorbed in the intestines, must necessarily be excreted by the liver. If owing to any cause this discharge is obstructed, then there occurs an accumulation of the biliary constituents in the blood and choluria is the result. The interference with the discharge of bile may be due to degenerative processes in the liver itself, or it may be due to some nervous influence.

Harley states as a physiological fact that all the secretions may be checked through the direct influence of the nervous system.

If a dog having a biliary fistula is petted the bile will flow freely, as was first demonstrated by Cl. Bernard; if, on the contrary, we abuse the dog, then the biliary secretion ceases immediately, and then, if we caress him again, the bile will again flow out though the canula. The influence of the nervous system upon the biliary secretion cannot be denied in this instance, and if this occurs in the dog it is very readily comprehended that the biliary secretion may in a similar manner be influenced in so highly developed an organism as man.

Harley gives several examples to prove that this is actually the case. Among other cases he observed one, that of a woman, who had had icterus twice in one year, each time after seeing her child in convulsions. In the "Annuaire de Thérap.," 1846, a case of icterus is cited which occurred in a man after having experienced great joy.

The icterus of enervation may be considered as the typical form of suppression icterus, for no organic change exists in the liver, nor is there any obstruction to the discharge of bile either into the intestines or into the gall-bladder; in fact, there is no palpable cause for the icterus. The liver appears to "strike;" it no longer performs its accustomed function. The bile is neither secreted nor excreted and icterus is the result, and we have the characteristic constituents of the bile in the urine.

Harley says that one reason why icterus is not more frequently due to unusual nervous influences is that it is necessary to have a sufficient amount of pigment in order to produce a visible color in the skin, and the influence of the nerves upon the biliary secretion is rarely intense or lasting enough in order to permit of an accumulation of pigment in the blood.

According to Harley, a blow upon the head, which may occasionally be followed by an icterus, acts in the same way as fright does; namely, by paralyzing the centres which influence the discharge of bile.

An icterus of enervation may not necessarily be dependent upon the central nervous system for its origin, for a diminution in the amount discharged may be due to any of the causes which produce a contraction of the arterial vessels in the abdomen, *e.g.*, irritation of the splanchnic and the nerves of the liver, which contain fibres of the sympathetic.

I saw a very peculiar case, which I can only look upon as one of reflex or nervous choluria. Owing to the fact that the case is a rare one, I shall describe it in detail.

Mr. S., a wealthy agriculturist, aged twenty-one, consulted me in 1874 for general lassitude and depression and on account of an icterus, which he had had for three weeks. Before this time the patient had been perfectly well and the picture of health. Up to the time of writing he had not had any diseases worthy of mention. His family history was excellent; his brothers—and they were many—were known to be unusually healthy, especially as regards their digestive powers and their sexual abilities. At the age of twenty Mr. S. served in a cavalry regiment, riding a very slow and hard-stepping horse. At the end of his service he noticed that he was not as sprightly as formerly, but could not discover any positive reason for this. On resuming the life of a private citizen he

noticed that he became tired very quickly, this condition having been previously unknown to him. From being the best gymnast, he found that this had entirely changed and that he had lost all desire for these physical exercises. Gradually his appetite, which had formerly been excellent, began to be poor. He could attend to his duties in the fields for half a day without experiencing any desire for food whatever. After eating he would feel uncomfortable for awhile. The bowels, which previously had always been regular, became sluggish. He had a frequent desire to urinate and felt sleepy very often. The neighbors noticed that Mr. S. no longer had his healthy color and that his eyes had a slight yellowish tinge.

On examining the patient, I observed quite an intense yellowish color of the conjunctivæ, and besides this, the skin was also slightly yellow. The tongue was not coated, but had the normal red color. Examination of lungs and heart gave negative results. Liver not enlarged nor painful. Stomach normal. Abdomen not distended. Stool grayish, urine yellowish-brown. In spite of the fact that the tongue was not coated, I made a diagnosis of chronic catarrh of the stomach and intestines with consecutive icterus. Treatment: strict diet, Carlsbad water. After continuing this treatment for some months, nothing had been accomplished except that the patient had lost a great deal of flesh and was much reduced as regards his general condition, and his icterus was more intense, lassitude and drowsiness more marked, his head feeling heavy and depressed. There was loss of memory and psychical depression. Mr. S. then visited various health resorts, drank mineral waters, took the cold-water cure, and was more careful and energetic than ever before in regard to a regulated diet. In spite of these efforts the result of treatment remained negative, and I decided to try washing out the stomach, a plan of treatment which at that time was not usually adopted. At the end of the proper time for him to digest his food, I found, to my surprise, that the stomach was empty, containing no mucus and no fermented matter whatever.

By accident Mr. S. once stated that his sexual desire had almost entirely disappeared. I considered this fact as being due to general debility and explained it to my patient in this way. He, however, said in reply that his present enfeebled

condition could not be the sole cause for his sexual impotence, for the latter existed on his return from military duty at a time when he was very healthy and strong. At that time he attempted intercourse with a girl with whom he had frequently had intercourse before and of whom he was very fond. He was much frightened on discovering that his former and unusually strong sexual desire had entirely disappeared. Emissions occurred occasionally, though there was no erection nor did he dream or wake up. He seldom if ever had any erections. At an early age (sixteen years) Mr. S. acknowledged to me that he first began to cohabit, but that he had never masturbated. He cohabitated daily, but in order to avoid making the girl pregnant, he had only done so incompletely for years, he, however, never noticing any ill effects. The first symptoms of his trouble began, as already stated, while in the cavalry service, appearing in the form of marked lassitude and followed by complete impotence.

That incomplete coition carried on for years could be injurious was clear to me, as was the fact that as a result of this impotence would follow; this condition being increased by severe riding for many months on a slow, hard-stepping horse. But that this sexual affection could have any relation to the icterus I could not then believe.

In the mean while he consulted numerous physicians, but was constantly losing ground. Since the beginning of his illness he had lost thirty pounds. He was unable to work, being in a most miserable condition both mentally and bodily. The icterus remained about the same. At this time, when my suggestions in the way of treatment were exhausted, I began at his earnest solicitation—he believing in a direct relationship existing between his illness and his anomalous sexual condition—a local treatment upon his sexual organs. I treated him in this manner more to satisfy him than because I placed much faith in this plan. I began by treating Mr. S. with sounds for a number of weeks, which seemed to cause a marked improvement in his condition; his head became clearer, his manner less moody, had slight erections, the pressure over the stomach was less severe, and his appetite became better. Ceasing the application of the sound, I began, after an interval of eight days, a local astringent treatment of the prostatic portion of the urethra, and then discovered a marked improve-

ment in his condition. His appetite was much improved, his subjective ailments gradually disappeared, and, strange to relate, the icterus also vanished. His sexual desires became stronger, and after following this local treatment for about four to five months, the patient was completely cured. By treating and curing the sexual affection the icterus and choluria disappeared, having steadily resisted the most careful dietetic and medicinal treatment.

For three years Mr. S. remained perfectly well; his former healthy appearance returned, when one day I was again called to see him. I found him in bed; he was tired, listless, and had no appetite; was constipated, and there was an incipient icterus, severe headache, frequent desire to urinate, slight choluria. The entire picture recalled his previous illness, and the patient himself declared that his present illness was due to his own fault. During the past year, having felt very well, he had formed a new acquaintance, and for the same reason as formerly he only practised an incomplete coition. He felt his health declining, but could not give up this habit, especially so as his sexual powers remained active.

We did not attempt general treatment at all, but began a local treatment, which produced the desired result very quickly.

A year and a half later Mr. S. married. His intercourse was normal and was not carried to excess. He has five children, and up to the time of writing has never had, during the elapsed period of ten years, any return of the troubles which we have described.

VI. Phosphaturia

is one of the most interesting neuroses of the kidneys. We understand by this condition the discharge at times of either a mildly acid, or neutral, or else alkaline urine, which when voided from the bladder has a white, cloudy color, and deposits on standing a large quantity of sediment, consisting for the most part of earthy phosphates.

This peculiar condition must be accounted for by a reflex action of the renal nerves through their specific action upon the glandular cells.

I refer the reader to my article on phosphaturia in "Volk-

kidneys and of the other urinary organs. Only in recent times has it been demonstrated that not infrequently there are exceptions to this rule, in which in perfectly healthy persons small quantities of albumin have been discovered in the urine, but more than this, albumin was found not infrequently to be present in cases of neuroses where there existed no lesion either of the urine-forming or urine-discharging organs.

In order to comprehend those conditions in which albumin appears in the urine, we must again consider the general physiological rules. As has already been demonstrated, the solid constituents of the urine are drawn from the surrounding lymph through the activity of the epithelium of the uriniferous tubules, especially in the curved ones, and are given off into the fluid of the uriniferous tubules. The discharge of serum-albumin is retarded in all probability by the membranes of the vessels—that is, by the epithelium thereof. As soon as the rapidity of the circulation in the renal arteries become so slight, let the cause be what it may, that the addition of carbonated arterial blood no longer nourishes the glomerulus epithelium, then the immediate result is the discharge of albumin from the blood. This is directly due to a diminution in the amount of blood passing through the arteries, and this condition may also be brought about through nervous influences. Cl. Bernard and others have demonstrated the fact that a lesion of various portions of the brain and spinal cord and irritation of the renal nerves produce a discharge of albumin into the urine. The changes in the condition of the circulation produced by these lesions play an important part in the formation of albumin, and may be directly attributed to a narrowing of the renal arteries, which depends upon a general sinking of the arterial pressure and a slackening of the circulation in the glomerulus.

Consequently we find albumin, 1, in all diseases of the brain and spinal cord. 2. In general neuroses, epilepsy, tetanus, and in cases of lead colic. 3. In diseases of the genital organs.

Under this category we include the case which I described under the heading anuria and oliguria, in which there was always a small quantity of albumin in the urine.

Ultzmann ("Vorlesungen über Krankheiten der Harnorgane") also claims that we occasionally find cases of renal al-

Ultzmann, for instance, states that he observed oxalate of lime in neurotic cases much more frequently and in much larger quantities than in cases of renal calculus. Oberländer also saw one case of neurosis in which there appeared large quantities of oxalate of lime. Under this heading must also be included the frequent presence of oxalate of lime in cases of spermatorrhœa—a condition which has been observed by many. I am sorry to say that, despite numerous microscopical examinations, I have been unable to discover this condition in urine containing spermatozoa.

Up to the present time I have observed very few typical cases of nervous oxaluria, and those that I have seen were, either accidentally or otherwise, always associated with alternating phosphaturia. Two cases of this variety are described in detail in my article on phosphaturia ("Volkmann'sche Vorträge," No. 336). In both of these cases the oxaluria was always associated with a vesical tenesmus, or, as expressed by the patient, "passing cold urine." Both gentlemen were physicians and one of them is a well-known urinary specialist.

Dr. K. described his oxaluria as follows: At times there was a tenesmus of the bladder independent of the phosphaturia, this occurring about once or twice in a month and then perhaps not again for six months. This condition began with a sensation of pressure in the region of the bladder and an urgent desire to urinate. The patient passed one or two drops of clear urine every minute, this being accompanied by intense burning. After this had lasted from half an hour to an hour it suddenly disappeared. The urine which was passed at this time showed an innumerable number of beautiful oxalic-acid crystals. Both this affection and the phosphaturia were due to sexual abuse, and were the result of a chronic gonorrhœa and were associated with marked neurasthenia and irritability of the bladder.

In the case of the other physician I do not know the predisposing cause. The exciting cause for the oxaluria, this being associated with excessive pain, was the occasional use of an acid or imperfectly fermented beer.

My third case was that of a farmer, Mr. T., aged thirty, strong and healthy in appearance and in good circumstances. From his twelfth year on and until recently he had masturbated without experiencing any ill results until about three

months ago, when a rapid change took place in his physical condition: he became very tired, psychically depressed, had headache, a dull heavy pain over the sacral region and also in the region of the coccyx, this pain lasting almost all day. His desire to urinate, previously normal, became more and more imperative until gradually there developed a severe tenesmus. For several weeks the patient urinated almost every minute, and in spite of his efforts to retain his urine he was unable to do so. He did not have erections. Appetite and bowels normal. On urinating, Mr. T. frequently examined his urine and noticed that it was very cloudy at times. He thought it was due to the presence of semen and consulted a number of physicians and quacks, who treated him both for his trouble and also for catarrh of the bladder.

When the patient presented himself to me, the marked irritability of his bladder had diminished to a great extent. On examining his urine, I found it to be cloudy and that there was marked phosphaturia, which appeared a number of times every day. Besides this there was a slight spermatorrhœa. Quite often, and then usually a few hours after the phosphates had been discharged, the urine which was clear contained an innumerable number of oxalic-acid crystals, so that in this case phosphaturia and oxaluria existed alternately and within a few hours of each other. By treating the spermatorrhœa locally, both of these secretory anomalies disappeared without using any internal medication whatever.

VIII. Indican and Indigo in the Urine in Neuroses.

According to Ultzmann, the presence of these two constituents in the urine of neuroses is not unusual. He states that not infrequently we find an increase in the amount of indican in neuroses. In people who masturbate we occasionally find large quantities of indican in the urine; and after pollutions we may frequently find, when this has dried upon the clothing, spots which show the presence of indigo and having a blue or violet border.

After sexual excitement, or after sexual excesses, we may occasionally find large quantities of indican in the urine. In nervous and hysterical women this occurrence is not an uncommon one. Oppolzer has called attention to the fact that

in cases of disease of the central nervous system, especially in cerebro-spinal meningitis, large quantities of indican have been found in the urine. The indican is usually found in the urine in solution, but it is not unusual to find indigo in the form of bluish or bluish-black scales and flakes in the sediment of the urine. Occasionally, but very rarely, the amount of indigo discharged is said to be so great that the sediment has a bluish color. If at the same time there exist in this sediment the salts of uric acid, especially the urate of ammonium, then these salts take up the indigo and appear blue or violet, besides having their characteristic form.

The presence of a bluish coloring matter has been observed for a long time, both in normal and pathological urine, the nature of which, however, was not understood until Schunk, in 1858, analyzed the indigo and indican and proved them to be normal constituents of the urine. The average amount of these constituentss is about one-tenth of a grain in two and a quarter pints of urine.

Indican is increased in all diseases which are due to any affection of the small intestines. It is spontaneously changed into indigo when exposed to the air.

IX. Accidental Pathognomonic Admixtures,

which are taken up by the urine of neuroses while being excreted.

Besides the changes which take place in the urine in the kidneys, it sometimes takes up organic matter in cases of neuroses, this being taken up as it is being excreted, and it is often pathognomonic in making a diagnosis of neuroses or in making a differential diagnosis; for it demonstrates the existence of anatomico-pathological changes in the genito-urinary system, these changes favoring the production of a general neurosis and of neurasthenic conditions—in fact, causing them.

In the female the admixtures which have to be considered usually come from the vagina. If, *e.g.*, we examine the urine of a very hysterical and anæmic girl, in many cases we are unable to discover any chemical abnormality; but if we allow the urine, which is not perfectly clear, to stand for a while, we discover in the cloudy sediment which forms a large amount of mucus, pavement epithelium, and leucocytes. Since

we are enabled to exclude a catarrh of the bladder by means of the subjective symptoms, we attribute the origin of these morphological products to be in the uterus and vagina. Where the conditions are such that it is impossible to make genital examinations, we are still able from the examination of the urine to diagnosticate an inflammatory irritative condition of these organs. This irritative condition is in many cases the cause of the hystero-nervous affection, especially, and as is often the case, when due to masturbation which has been practised for a number of years. Consequently in these cases we are enabled, by the examination of the urine and almost entirely by this examination, to diagnose to the cause of the neurosis and to recognize the anatomico-pathological seat thereof.

In the male the variety of admixture is much greater on account of the complicated arrangement of the genito-urinary canal. The symptoms of the so-called neurasthenia, which depend upon anomalies in the genital organs, are very varied, and for any one who does not frequently meet with these cases very confusing. It does not come within the scope of this work to enter into details, but we will only describe what is found in the urine in cases of neuroses and through which our attention is first called to its existence, or where the diagnosis is in doubt this confirms the same.

The most difficult and at the same time the rarest constituents which are found in the urine are

The Secretions from the Accessory Genital Glands.

During erections and other sexual excitations a sticky, thready secretion, clear as glass and having an alkaline reaction, is frequently discharged. Its source has recently been discovered to be from Cowper's glands. At times, in cases of chronic irritation of the genital system, this material is discharged with the urine without the patient's knowledge and is accumulated in considerable quantities in the bottom of the urine glass, appearing as a tenacious mass, clear as glass. This, owing to its transparency, cannot be recognized with the naked eye, but is accidentally raised in the form of long threads by the pipette in seeking for other things. Under the microscope this mass has no form, showing mucous corpuscles

and epithelium, but sometimes we see a large number of very pretty coffin-lid crystals and pointed crystals of neutral phosphate of lime. This discovery proves that the mucus has an alkaline reaction, and this is substantiated by the use of litmus paper.

The urine is, however, acid, and consequently we have a strongly alkaline mucous sediment in a urine which is decidedly acid. This peculiar discovery I have found particularly often in cases of neurasthenia dependent upon chronic irritation of the sexual organs, as is frequently found as a result of too frequent coition in young married men or in cases of masturbation.

A number of times I have been able to diagnose sexual neurasthenia from the presence of this matter, discovered microscopically, in the case of young people in whom the cause was sexual abuse and who at first denied this.

Not infrequently this affection is mistaken both by patient and physician for another affection of the genital system, which can also usually be discovered only by means of a careful microscopical examination of the urine, namely,

Spermatorrhœa.

This is more often indicated in the urine passed in the morning than in that which is passed during the day. The elemental forms of the spermatic fluid which are found are principally seminal threads and lymph corpuscles; the so-called sperm crystals are soluble in urine and consequently they can never be demonstrated if the semen has been mixed with the urine for any length of time.

Not infrequently we find the spermatorrhœa in the last drops of urine which are passed after having had a movement from the bowels (Fürbringer's Miktionsspermatorrhoe). These drops are cloudy, milky, and viscid. On microscopical examination they appear as pure pollutions.

At times the sperma may be voided with the beginning of the urination. I saw just such a case in which the urine, which was passed in my presence, was so cloudy, owing to the sperma which it contained, that it looked like a case of phosphaturia, or like one of severe catarrh of the bladder.

But, as a rule, the sperma only causes a slight cloudy con-

dition in the freshly voided urine, and when passed it does not glisten. It becomes so, however, after a time, whereas in the bottom of the vessel a slight cloudy sediment is formed, and this can be brought under the microscope with a pipette.

In urine containing sperma we occasionally meet another formed element, namely,

The so-called Testicle Casts.

These are hyaline casts, which under the microscope cannot be distinguished from hyaline casts of the kidney. But the absence of all chemical anomalies in the urine and the presence of spermatorrhœa establish the diagnosis.

This discovery is a comparatively rare one, and of the large number of microscopical examinations that I have made I have scarcely seen this condition more than half a dozen times.

I remember very distinctly the case in which I observed these casts for the first time, as at that time I knew nothing of their existence. The case occurred in a young merchant who consulted me on account of a chronic diarrhœa, marked emaciation, and a number of neurasthenic symptoms. On making a chemical examination of the urine I found nothing abnormal, but microscopically I found a moderate degree of spermatorrhœa and hyaline casts, these being rather broader than renal casts. I believed I should discover disease of the kidney and made the most careful examinations, and naturally with negative results.

In another case, a tailor thirty-eight years old, who had spinal irritation and complete impotence, I found quite a number of these casts. It was impossible to distinguish them from renal casts.

The most frequent discovery in the urine in neuroses are certainly

The Urethral Threads.

These are the result of a chronic urethritis, either due to infection, or masturbation, or any other cause.

We are well aware that chronic posterior urethritis is the principal pathologico-anatomical cause in the large majority of cases of sexual neurasthenia.

If we examine the urine of such a patient when voided the first thing in the morning in a glass bottle and examine it by transmitted light, we observe very small, white threads floating around, which under the microscope appear as mucus threads, and in which numerous pus-corpuscles are lodged, sometimes mixed with epithelium and in some cases with a larger or smaller number of sperma threads.

If the mucous contents of these urethral threads predominate, they are elastic and transparent; if, however, the cell elements predominate, then the threads appear cloudy and broken.

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By accident Mr. S. once stated that his sexual desire had almost entirely disappeared. I considered this fact as being due to general debility and explained it to my patient in this way. He, however, said in reply that his present enfeebled

THE TREATMENT OF UTERINE AFFECTIONS BY MASSAGE.

THE method of applying massage in the diseases of women was first demonstrated in Jena by Thure Brandt, and the results, in the hands of physicians who had learned the process from its author, were surprisingly good. Impressed by this fact, I applied to Thure Brandt for instruction in his methods, and now take the opportunity of publishing them. He calls his system the treatment of female abdominal disorders by gymnastics, and includes in it both the general treatment of the constitution and the special operations for the particular organ involved; the first signifying proper exercises for the whole muscular system, which shall increase its strength, improve innervation, and regulate the vascular tone. Its value is evident from the fact that women who have affections of the genital organs usually suffer also from more general troubles, such as constipation or diarrhœa, debility, neuralgia, and cold extremities. The special treatment consists of certain exercises which influence the different organs directly or indirectly. By combining the two, Brandt obtains a rapid improvement in the patients' condition, which they notice even before he discovers any sign of it. His special movements are largely borrowed from the Swedish system, but he has particularly selected and modified about fifty which are particularly suitable for use in gynecology. For the most part he employs movements which tend to lessen the blood-supply of the pelvic viscera, either in the active, the passive, or the double form of application. The active set of movements are those which the patient voluntarily makes; the passive, those applied only by the masseur; the double, most frequently used, combine the characters of the

[illegible] former and are applied by the physician against the resistance of his patient.

The physiological result is, in either case, an increased arterial stream to the part involved, and experience must decide just which movements are needed to influence adjacent or distant parts of the body. Brandt directs that the massage shall begin with a movement of the respiratory muscles and then shall be followed by exercise of the hip, the head and neck, the lower extremities, and lastly the breast. In each case there are variations—*e.g.*, in constipation, passive motion and kneading of the abdomen are introduced.

Motions which lessen the blood-supply of the pelvis are indicated in hemorrhagia, metrorrhagia of any kind, and inflammation in the pelvis, or their sequelæ. The contrary motions are required in amenorrhœa without mechanical obstruction in atrophic uterus, in chlorosis without dyscrasia, and in certain forms of dysmenorrhœa, but are injurious in all pelvic inflammations and uterine hemorrhages. The [illegible] kind of motion I observed during October in two [illegible] girls who menstruated only every seven or eight weeks, and then but scantily. After treatment by [illegible] they menstruated more copiously than [illegible] twenty-eight or thirty days; and the peculiar [illegible] of the women improved at the same time.

[illegible] method can be used even for patients confined to [illegible] with great success.

[illegible] the particular applications of motion, I [illegible] describe Brandt's manner of examining women, [illegible] differs from the usual customs of gynecologists in [illegible] points. He examines a patient in a half-reclining position, the back a little raised and the knees drawn up, and the finger is introduced into the vagina below the left thigh; in this way the patient is not exposed. For bimanual palpation the patient's clothes are loosened, the physician sits on a chair somewhat higher than the bed at the left side, and fixes the left foot of the woman with his left knee. If necessary, the speculum or the sound can be used in this position, and a complete and painless examination made. At first the right hand is laid upon the abdomen and by gentle massage the muscular tension is removed; then the finger of the left hand is introduced, by separating the labia and following up

the posterior vaginal wall, thus avoiding all excitement of the clitoris and urethra. If the hand is held open, with the thumb strongly abducted and the three fingers at a right angle, much higher points may be reached than if the fingers are flexed, and it is less painful to the patient than if the knuckles press strongly against the perineum.

One great advantage of this method is in the ease with which both sides of the vagina may be examined by the left index finger, in contrast to the usual advice that both hands should be trained, as each hand examines the side corresponding to it most advantageously. With Brandt's method one hand is sufficient. The examination is facilitated if the hip of the side to be palpated is raised. On first seeing a patient, Brandt employs the upright position also, for a normally anteverted uterus may, in the dorsal position, be found retroverted. Rectal palpation is also necessary the first time a patient presents herself, especially to discover posterior adhesions of the uterus, dislocated ovaries, and inflammatory exudations; frequently, also, in differential diagnosis between salpingitis and ovarian disease. With moderate force the finger can reach beyond the sphincters, up to the sacro-iliac articulation. By pressure upon the anterior rectal wall, which allows a good deal of motion, the cul-de-sac of Douglas, the tubes and ovaries, and any anomalies of formation can be explored. In difficult cases Brandt employs the rectal examination in the standing position, with the left index in the rectum and the right arm about the hips of the patient; in this way he always succeeds in reaching above the internal sphincter without causing the patient much pain.

Considering now the special methods, I begin with the most important, massage. The physician sits at the left side of the patient and a little higher, rests the left arm on the left knee, and with the right hand applies the massage, but the motion is chiefly from the shoulder and but slight in the wrist. As little force is used as possible, and the patient assists, in her position and her breathing, to lessen resistance.

Brandt confines his massage wholly to the abdomen, making small circles with two or three fingers of the right hand, while the left steadies the organ to be influenced from the vagina or the rectum or lifts it toward the massage. It is important that the process should be carried out in this way

in view of the crude methods of empirics, who accomplish merely increased blood-flow to the abdomen.

Brandt begins with circular strokes over the lymph ganglia near the promontory, and directs that the line of the lymphatics be carefully followed centripetally, his first strokes being very gentle, with careful observation of the patient's face for the first sign of pain. If there is no sensitiveness the pressure is slowly increased, with short periods of rest, and at the end, after making less and less pressure, the hand is laid over the inguinal regions for a moment and the patient's attention directed to the ovaries. The hand's warmth is pleasant to the patient and relieves any tenderness that may be present. The uterus is treated only from the side or posteriorly, to avoid irritating the bladder, with the organ anteverted, if necessary, by a finger in the vagina or the rectum. If fixation of the retroverted uterus is the cause of hemorrhage, the bladder can no longer be considered; and in some cases of anteflexion, also, massage must be employed on the anterior surface of the uterus.

After every massage general gymnastic exercise is employed to decrease the blood in the pelvis.

Brandt divides the influence of massage into the immediate and the mediate, or direct and indirect, according as the force used is greater or less. The direct results are increase of lymph and blood streams from the part, absorption of transudation and exudation, stretching of scars and adhesions or complete destruction of them.

By pressure over a lymph vessel its contents are hurried forward, and, owing to the valves, it is filled again only from the periphery; in other words, the action of massage is pump-like when the strokes are applied toward the heart. Exudations are crushed and rendered capable of absorption under the influence of repeated strong pressure, even though they may be old and hard; while the nerves of the neighborhood are rendered less sensitive and pain is removed. Simple mechanical results of massage are, then, increased local temperature, absorption, and anæsthesia.

The indirect effects of the process resemble those of electric, thermic, or chemic excitement of the vaso-motors and the muscles. Thus gentle rubbing of the uterus will produce contraction of the vessels and also of the muscle fibres, and,

in an atrophic organ, improvement in its strength and nourishment. The special affections of the uterus and adnexa which are benefited by massage are as follows:

Atrophy of the Uterus.—Here gentle massage and strong derivation of blood to the pelvis are indicated. The "infantile" uterus, with small body and long neck, improves but little; other forms are soon influenced for the better.

Hyperinvolution. — Daily treatment gives surprisingly rapid return to the normal size.

Atrophy after wasting Disease.—Cases of atrophy in the course of diabetes, phthisis, etc., are never proper cases for massage.

Uterine Hemorrhage.—According to the origin of the bleeding, these cases are very satisfactory, or not to be improved at all. A central cause, like hepatic or cardiac disease, or local causes, like carcinoma, are beyond the reach of massage as a matter of course, though even here ab-derivation may be of assistance. In some cases of uterine polyp the tumor was partly extruded under massage and thus operation facilitated (Brandt). The bleeding which accompanies fibromyomata may be lessened by massage, but the tumors themselves, especially if their attachments are broad, are not decreased in size. In hemorrhage after abortion light strokes cause the dilated vessels and the lax fibres to contract, whether there be merely atony of the uterine wall or also retention of the membranes; the application must be short and all pressure avoided. Here may be mentioned, next, hemorrhage in chronic atony, as described by Lomer and Fritsch, where the uterus is thin-walled, lax, and easily dilated, and where the curette removes nothing and brings no improvement. A case I lately saw is a good example:

Woman with profuse menses, bleeding for three weeks; uterus small, lax, and thin-walled, and hence no possibility of abortion; I sent for tampons and applied gentle, short massage, as experiment; uterus contracted, bleeding ceased. Applied then Brandt's method for patients confined to bed, for pelvic ab-derivation. Observation for hours convinced me that the uterine contraction persisted. Treatment continued a week; no more bleeding.

In such cases massage is highly advisable and useful.

Bleeding from stasis requires removal of its cause; in retroflexion, for instance, it often ceases if the malposition is corrected.

Where bleeding is a symptom of metritis or endometritis, the rule is to use very gentle massage until the hemorrhage ceases and then to increase the force as well as the time of application. In most cases all symptoms disappear and the patient declares herself better, but in the indurated stage of metritis results are far less satisfactory. Brandt is convinced that in endometritis not of infectious origin, his method, far better than the usual cauterizations, etc., prevents return of the malady. The massage should be applied from fundus to isthmus, from angle along parametrium to pelvic wall, and only on the posterior surface of the uterus. If the cervix is especially involved, the attention must be directed to that part, and it must be massaged from its external orifice upward. As the catarrhal discharge decreases the erosions disappear, as is easily understood if one remembers their mode of origin. Brandt asserts that he has always cured erosion without the use of vaginal douches.

Para- and Peri-metritus.—In the stage of acute inflammation massage must never be employed; only after fever and pain disappear can benefit be expected from it. At first, experimentally, the session is short and the force gentle, the strokes being delivered from the periphery of the exsudate toward the centre. Brandt advises against careless and perfunctory massage of every pelvic swelling, for there is danger of opening a path for the pus into the peritoneum. Cicatricial and adhesive bands which cause tension and shortening of the ligaments require very strong massage for a long time, beginning at the circumference of the pelvis and stroking toward the uterus, which at the same time is pressed toward the median line, or even beyond it, sidewise, thus stretching the shortened bands. This should never cause the patient any suffering.

Lateral malposition can result from shortening of one ligament or relaxation of the opposite one, and similarly in axial twist of the uterus, one of the sacro-uterine ligaments may be either very tense or very loose.

All adhesions which result from former perimetritis are benefited by massage, if not curable by that means alone.

Fixation of the uterus demands the greatest care and patience, and Brandt's own rule is, "never too much at once; next time more can be accomplished." By slow and careful stretching one usually secures the desired result; if the adhesion is slight and the uterus hyperæmic, five to eight days may be enough; the broader bands may take months. In some cases the fixation is only apparent; here massage and gentle pressure in different positions will render the uterus freely movable. When the ovary is fixed, care and patience are again required; pressure and stretching may allow painless removal of the organ from its adhesions; and the more gently one operates, the more rapid is the cure and the less danger is there of returning trouble. In many cases of supposed inflammation there is really a hæmatoma, which may disappear in two or three daily sessions, the massage being combined with ice applications.

In chronic exudations more force is required, even to thorough kneading with the ball of the hand; but the controlling finger must always be in vagina or rectum. It is in these long and difficult cases that the best results are often obtained.

Malpositions of the Uterus.—Thure Brandt never uses the old method of replacing a retroverted uterus with the sound. He examines most carefully for adhesions and ascertains the exact position of the organ, and by changing the patient's position determines whether there is relaxation or tension of any of the uterine ligaments. Reposition, like massage of the part, must be free from pain, and hence all inflammation must first be overcome, so that the uterus can be painlessly returned to the middle line of the body. When the uterus is fairly movable, bimanual palpation secures a knowledge of its form, size, and consistence, and indicates how it shall be replaced.

In general, a retroverted or retroflexed organ, as we begin to replace it, moves without hindrance up to a certain point; there a difficulty is met, and, as soon as that is passed, the uterus falls of itself into the desired position. That is, when the uterus is retroflexed the broad ligament is shortened, the round ligament lengthened and rendered tense; at the beginning of reposition the shortening of the broad ligament is lost, and both this and the round ligament reach their great-

est tension at the same time; as soon as this is overcome, the round ligament shortens, and, by its elasticity, draws the uterus forward.

The easiest method of replacement is the "overthrow," indicated in large uteri bent sharply backward, and performed in the upright or the knee-elbow position. The left index is introduced high into the rectum and exerts pressure on the fundus forward and downward, at the same time the thumb in the vagina presses first back and then up on the cervix. If the uterus does not return at once to its normal place, this is accomplished bimanually in the half-reclining position. This is the recto-vaginal method.

The ventro-vaginal methods are used in the lithotomy position; the only one deserving extended mention is as follows: When the portio is directed forward and is fairly rigid, the left index is placed under the fundus and an attempt is made to lift it toward the abdominal wall. Then the fingers of the right hand press backward just above the symphysis toward the isthmus uteri; at the same time the exploring finger is laid on the anterior side of the cervix and strengthens the pressure from without. Thus the uterus is pushed upward parallel with the sacrum and the fundus is directed anteriorly. The movement is completed by circular strokes of the right hand forward, from behind the fundus, the finger upon the cervix lifting up and backward. The ventro-recto-vaginal method is particularly useful when the examining finger does not reach the fundus. Here the left index is introduced into the rectum, as before, as high as possible, the tips of the right fingers find the fundus through the abdominal walls by gentle shaking and rubbing, and are pressed quite strongly downward as the finger in the rectum presses forward. If this does not succeed, the left thumb presses upon the cervix as before.

When once replaced, the uterus may be held in the proper position by a well-selected pessary; but all pessaries stretch and irritate the vagina too much, and even with the greatest care and patience it is difficult to select a proper form. Brandt never uses a pessary, but substitutes a procedure of his own by which the uterus is elevated, with its adnexa, by the hands of an assistant under his own direction and control.

Of this method there are four varieties.

Elevation in Prolapse.—Lithotomy position; left finger in

vagina; uterus replaced and held in anteversion by pressure on cervix. Right index, dorsum anterior, laid on fundus anteriorly as guide to assistant, who, with one knee resting upon the couch, presses his hands deep into the pelvis between uterus and symphysis, grasps the uterus in his fingers, and lifts it slowly and with little force, by circular interrupted motion, so high that vagina and all ligaments are well stretched, holds it thus a short time and slowly releases it; finger of physician in vagina receiving it as it descends; then pressure on cervix prevents return to malposition. This procedure is repeated thrice at each sitting, with pauses between. The bladder should first be emptied and the time should not be earlier than two hours after a meal.

Elevation in Retro-Positions.—The assistant sinks his hand so far between symphysis and uterus that anterior attachments are relaxed; then moves his fingers back and up along sacrum till physician's finger in vagina perceives a marked stretching of isthmus; the organ is held thus a moment; then assistant lifts his hands directly upward, and finger on cervix feels uterus fall forward over it.

Elevation in Latero-version.—One hand of assistant as usual between symphysis and uterus, the other presses from side toward which uterus turns upward and to median line, while other hand massages broad ligament; finger in vagina during whole time exerts opposite pressure upon cervix.

In Large or Gravid Uteri.—Here but slight elevation is required and the method requires extreme care. That these elevating procedures cannot be effected without an assistant is obvious. I employ a woman trained in Swedish movements, who also directs the patient's exercise under my control.

In all elevation methods it is important that the patient remain passive; her movement is accompanied by intra-abdominal pressure which pushes the uterus down, or back and down. As she rises from the couch she is directed to stiffen the back, and then grasping the shoulders with his hands, the physician assists her to regain the upright position. Then the position of the uterus is corrected or confirmed by the finger in the vagina, she is directed to lie upon the bed face downward for fifteen minutes, and several times in the day to use a vaginal douche of cool water; only a little is needed. Finally at stool she is forbidden to strain, and advised to aid

the expulsation of fæces by supporting the abdominal wall with the forearm. In prolapse of the vagina she must exercise the adductors of the thigh by strongly crossing the legs, and the muscles of the perineum by frequent movements as if to hold back the fæces. With the procedure of elevation Brandt combines pressure upon the hypogastric and solar plexi and the pudic nerves.

In cases of rectocele the procedure consists of

I. Sacral percussion;

II. Elevation;

III. Uterus elevation;

IV. Thigh-adduction against resistance.

The lifting movements are performed in lithotomy position; physician on right side, left hand on patient's shoulder, right hand pressed into lower abdomen seeks to lift upper part of rectum in short, interrupted movements. Thus the rectum is stretched, as one can demonstrate by a finger within the anus.

To strengthen the pelvic muscles the patient is placed in the lithotomy position with hips raised, and the physician places his hands on the inner side of the knees. As he presses them apart, the patient endeavors to overcome the resistance by movements of adduction. By this exercise the muscles of the floor of the pelvis are contracted and strengthened; especially the levator ani, as one can appreciate by a finger in the vagina during its employment. The contrary exercise, with the hands pressing the knees together and movements of adduction on the patient's behalf, exerts a strong influence of pelvic ab-derivation and is used after almost every massage where such effects are desired. Each exercise is done thrice at any one time. Brandt also lays stress upon the value of percussion over the lumbar and sacral regions. The strokes are gentle and short, delivered with the half-open hand, five strokes on either side of the lumbar spine and five on either side of the sacrum. Gentle strokes decrease the blood-supply and raise the nerve power, the stronger are blood ad-derivative (amenorrhœa). In each elevation of the uterus the important point is that the normal anteverted position shall be attained and maintained; this Brandt's methods certainly do. He has even cured a case of prolapse and complete perineal laceration; in view of which fact it might be well always to employ his methods at first in laceration of the perineum, and

to proceed to operation when the parts are strong and in good condition.

Prognosis and Duration.—In prolapse the first improvement begins very quickly, and when it does not occur before the second week there is but little hope of bettering the case. In retro-deviation the time necessary varies from a few days to months; usually it is long. But, as some of Brandt's cases show, patience and persistence are usually followed by success; for instance, one case (prolapse) of thirty years' standing in a woman æt. 69, and another of forty years' standing in a woman æt. 71, were cured by his procedures.

The first favorable symptom is that the uterus no longer appears outside the vagina, its volume decreases, especially that of the cervix, the sacral pains disappear, the erosions heal, and a general feeling of well-being is described by the patient as soon as the normal position is regained. Finally, let me repeat that the methods of Thure Brandt should be used only as he prescribes and should always be combined with general exercise.

COSMETICS;

A TREATISE FOR PHYSICIANS.

BY

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COSMETICS.

CHAPTER I.

INTRODUCTION.

THE minor ailments of which the following pages treat have been neglected by medical science. The literature upon the subject of cosmetics, which is quite abundant, is made up in part of excellent works by manufacturers and pharmacists intended for others in the same calling, in part of treatises written by the laity for lay readers. Even medical authors, as is shown, for instance, by an early work of the old master Dittl or a publication of Dachauer's, scarcely accomplished anything except to copy recipes which could scarcely be utilized by the physician, from works such as those described above. There have been a few authors—Auspitz, Pinkus—who have treated of limited provinces in this field in medical monographs. Still the physician is wrong in overlooking the study of the science of cosmetics, for with a knowledge of this he cannot only be of service to patients who suffer from slight blemishes, but he can also guard them against dangerous experiments.

With this idea in view, I have endeavored to present the outlines, in which shall be found the methods of action as well as the results of modern dermatology.

In treating of the latter, I have adhered to the teachings of the Viennese school, as can readily be imagined. The views which the exponents of this school—Hebra and Auspitz, Kaposi and Neumann—have advanced in their works will be found in the following pages.

In reference to individual remedies and their *modus operandi* and also the directions for use, I relied principally upon

my own experiments, even though the works of Husemann, Vogl, and Bernatzik, and especially the technical treatises of Atkinson, Engelhardt, Hirzel, Piesse, and others, contain many valuable points.

Most of the prescriptions I have had prepared by my friend Mr. Stolden (pharmacist—Rathhausapotheke), and here I desire to thank him for his courtesy. I employed the remedies on dead subjects and upon the living. The purpose of this book will explain why I have been indifferent regarding the perfume of the preparations.

The historical introduction which follows, and which represents the development of the science of cosmetics in stages, is far from complete. If it were so, it would lead us far beyond the scope of this work. Nevertheless, I hope these pages will prove interesting to the reader.

It would be impossible to answer the question as to what constitutes personal beauty in a manner which would be satisfactory to everybody. The physician defines this differently from the artist; the philosopher has still another definition; youth decides differently from old age. Beauty is "one of the great secrets of nature. We all see and experience its effects; but an exact general idea of its characters belongs to the undiscovered truths."[1] Among the ancients, the Greeks considered their ideal in a combination of goodness and beauty, *καλον καὶ ἀγαθον*; in like manner later authorities on art and philosophers found general beauty in "a complete harmony between the body and its component parts." This, in its greatest development, required a state of perfection which is unknown to human beings; but beauty itself had some of its greatest triumphs in classical ancient times, and its method of acquirement, apparently changing in subsequent centuries, really remained the same.

As a rule, we cannot define our ideas of bodily beauty; the latter is not "geometrically exact;" if it were, there would be no difference of opinion regarding it. Ideas of beauty vary among different nations and among different races. Even among the same nation, opinions regarding human beauty differ. Such opinions depend upon individual taste and are founded not only upon regularity of form and on color, but also on expression and grace, and in addition are influenced by the tyrannical laws of style.

It is obvious that beauty must be considered differently in one or the other sex, in various races and at various periods of life. The child, the young girl, the adult man, the old woman, each may be possessed of beauty peculiar to and corresponding to that period of life. A European, a Persian, a Nubian—each may represent a distinct type of beauty, and yet we may regard them all as beautiful.

Then we arrive at the influence of taste. There can be as little question regarding what is customarily and habitually considered as beauty and the means employed to enhance this, as there can be any doubt about the use of ornaments (which are really closely allied to cosmetics) and the portions of the body on which we prefer to wear them.

Though these differences in taste be ever so great, there exists in all mankind the science and the desire to ornament themselves, to improve the beauty of body and face in order to appear more favorable in the eyes of male or female companions. The means employed may differ, but the object remains the same. A great many of the wild tribes paint the body with horrid colors, or make these permanent by tattooing, or dig scars into the body (Nubians). Leaving out of consideration these savages who paint the body different colors and apply red and blue or yellow and white to the face, as the women of Greenland do, and regarding only the ancient races of culture, it is astonishing how these procedures, governed as they are by style, have been preserved. In the oldest historical times perfume was employed, color was applied to the face, hair was burned, crimped, and dyed just as is done now; even the same cosmetics are employed now that were used centuries ago, though their number has increased. These remedies either were guarded as business secrets by druggists and physicians, or they were promulgated from woman to woman. Curiously, there is scarcely any mention of cosmetics except those used by women—they seemed to have an historical right to use them; but in the case of the male sex, scarcely any are mentioned except perfumery and hair remedies.

In ancient Egypt the young girls were in the habit of powdering and painting, of coloring their pale lips, and of greasing their hair with odorous oils. They also colored their finger-nails and toe-nails orange with henna, just as many Orientals still do. (Among the educated Egyptians, in burial

rites the endeavor was made to preserve the exterior of the body as much as possible even with the mummies; hence such bodies are found in which nails were colored red and others in which they were gilded. Perhaps Egyptian women also gilded their nails during life.) They were so well up in these practices that they blackened the eyebrows and lashes in order to brighten their glances. Both remedy and method have remained the same up to the present time. Black sulphide of antimony (mestem) is employed not only by the Egyptians of to-day under the name "kochl," but it is also used elsewhere. The form of metallic rouge-bottles which were sold in Egypt at that time is about the same as what we see pictured as antique salve-jars—alabastra. Even the stopper, elongated into a stem to be dipped into the paint, was not missing. Such a holder tipped with color was placed between the open eyelids, the lids closed gently, and the mestem was rubbed into the edges of the lids and the lashes; then followed the painting of the lower lid and of the eyebrow. A recipe for a hair-dye is credited to Schesch, the mother of Teta, who was the wife of the first King of Egypt; this is the oldest prescription known. The cosmetic science of the mouth was also developed; to perfume the breath, it was customary to chew mastich branches or to use cachous. These pastilles were prepared from *kyphi*, an incense, the recipe for which is still preserved; according to Dioscorides it was made of honey, wine, raisins, large and small juniper, cardamom, calamus, galange, rosin, myrrh, aspalathus, clover, mastich, asphalt, fig-leaves, sorrel.[2]

The Jews learned these toilet customs, among other things, from the Egyptians, and they carried a part of this knowledge with them. Even though some of this knowledge was lost during their wanderings, much of it was retained; and when they settled and prospered and had more and more intercourse with other nations, the knowledge of these toilet customs was applied more generally. At first this was confined chiefly to the use of odorous salves and of perfumes in general in the observance of religious ceremonies, but afterward these were also employed in the houses and as an adjunct in the toilet. Consecrated oil was made by digesting myrrh, cinnamon, cassia, and calamus in oil; this was used in anointing Aaron and his sons. Later kings were anointed and finally oil was

employed for general use. This use of oil was considered a luxury, or at least a sign of comfort, as is shown by many examples in the Scriptures: "Thou anointest my head with oil." This is also indicated by the fact that the Jews and Egyptians deprived themselves of this procedure when in mourning. (The Essenes were the only ones who did not anoint themselves; they regarded it as uncleanly.) As a perfume for private uses the Jewesses[8] used henna blossoms; they had learned this in Egypt, but the plant also grew in Judea. The white blossoms are agreeably fragrant. It is uncertain whether they also employed henna as rouge, as was done in Egypt; it is probable, for they were familiar with the other Egyptian cosmetics. The paint for the eyes—"mestem"—is called in the Scriptures "kochl," a name prevalent to-day. Later, improvements in the toilet advanced rapidly, and in the Scriptures one of the prophets makes a comparison to courtesans, among whom such embellishments were probably most frequently found.

Besides henna and kochl, another toilet article was mentioned; it was called "puch," and probably it was also an expensive paint or perfume (2 Kings, ix. 30; Jeremiah, iv. 30).

The third daughter of Job was called *Keren hapuch* (Job, xlii. 14), which means "paint-jar." The more the Jews mingled with other nations in commercial pursuits and then in wars, the more extensive became the use of cosmetics which were quite common among the Persians and the Babylonians. Certainly no lady ever consumed a longer time in completing her toilet than did a maiden intended for King Ahasuerus (Esther, ii.). She required one year to finish this noble object; for six months she was perfumed with balsam and myrrh and for six months more she was embellished. So that she probably understood the art of using cosmetics and its secrets.

Among the Greeks and Romans, too, the science of cosmetics was looked upon very favorably. At first, as far as literature enables us to estimate, it was quite simple and was limited to abundant bathing and anointing the body after the bath. At first the anointing was done with simple oil or lanolin. Odysseus returning as a beggar received a foot-bath followed by an anointing with oil. Penelope was anointed while asleep with ambrosial oil of Cytherea. Later, odorous materials were added to the oil; then the plain oil was used

as a hygienic remedy—by men after bathing or before battle; the artificially perfumed oil, "myron," which the Greeks became familiar with from Asiatic races, was considered an article of luxury. Apothecaries sold not only medicines, but also cosmetics. The use of these perfumes became so elaborate that different varieties were applied to different parts of the body; thus, Egyptian salve was applied to the feet and thighs, Phœnician salve for the chin and breast, sisymbrium salve for the arms, amaracus salve for the hair and eyebrows, serpyllon salve for the knees and back. During this later period the women of Greece probably also painted. They were also familiar with "diapasmata," which was made from fragrant flowers and other substances powdered and was used to absorb the sweat, to perfume the bed, and finally to perfume clothes, being made into bags like the sachets now employed.

The odorous salves were of firm and of fluid consistence; the former seemed to be used for inunction, the latter as perfume.

The Romans acquired the knowledge of this luxury from the Greeks and extended it after their power became so great, until finally it acquired a degree of perfection almost abreast of that of to-day. Catullus, Ovid, Martial, Petronius, and Lucian give such complete recipes and directions that we can readily imagine the toilet of a Roman lady and possibly also that of a Roman "incroyable."[4]

In the evening the face was covered with paste, consisting of crumbs of bread in milk (poppæana) or else of fatty beans, "aut tegitur pingui terque quaterque faba" (Ovid).

This not over-appetizing (nec amabilius) coating was removed in the morning by water, or by an emulsion prepared with ass' milk (Poppæa, the wife of Nero, is said to have had one hundred asses with her constantly) or with lait virginal (myrrh and corn).

Many ladies were afraid of water or of fluids in general for their toilet, and removed the perspiration accumulated during the night by using powder (diapasmata).

Besides these simple remedies, many ladies employed others which were more complicated and which were recommended as beautifying agents. Ovid gives many examples in full:

Hordea, quæ Libici ratibus misere coloni
Exue de palea, tegminibusque suis
Par ervi mensura decem madefiat ab ovis
Sed cumulent libras hordea nuda duas;
Hæc ubi ventosas fuerint siccata per auras,
Lenta jube scabra frangat asella mola
Et quæ prima cadunt vivaci cornua cervo
Contere. In hæc solidi sexta face assiseat.
Jamque ubi pulvereæ fuerint contusa farinæ
Protinus in cumeris omnia cerne cavis.
Adice Narcissi bis sex sine cortice bulbos
Stenua quos puro marmore dextra terat.
Sex tantemque trahat gummi cum semine tusco
Huc novies tanto plus tibi mellis eat.
Quæcumque afficiet tali medicamine vultum,
Fulgebit speculo levior ipsa suo.

(Ovid, de medicamine faciei liber.)

Barley, sent by ships, from the barn-floor of the Lybian farmer
Is first separated from the chaff and shelled.
Then take ten eggs ; moisten the same quantity of peas;
The grain itself must, however, weigh two pounds ;
After you have dried the mass thoroughly in the wind
The ass shall grind it slowly,
And the horns which first fall from long-lived deer
Rub together, take four ounces from the full pound ;
After you have mixed this thoroughly with the powdered flour,
You must bolt this vigorously through a curved sieve.
Add the bulbs of twelve daffodils without scales,
Rubbing them only in clean marble vessels.
Then two ounces of Tuscan grains and gum,
And pour in nine times as much honey.
If then you rub this mixture on your face
It will become so bright that your own mirror will not be more so.

Hands, face, and breast were rubbed with the fat of sheep's wool. Unfortunately they were not acquainted with the means of purifying this, and its bad odor may have caused many a fair Roman to regard its application as a disagreeable act.

Non semel hinc stomacho nausea facta venit.

To remove the fat from the hands, soap was used; there were two sorts: Gallic and German. The latter was made from the ashes of the beech and goat's tallow, and was, according to Plinius, considered the preferable. After washing, milk was poured on the hands and then they were dried upon a fine linen cloth or in the hair of a boy. When a bath was

desired it consisted of meal (farina lupini), in order to make the skin very smooth, and it was often perfumed with oil of jasmine or similar perfumes; these baths were taken not only in the bathing establishments, but also at home, in the most costly silver extensive bath-tubs. Then the nails were cut, and marked callosities were removed, undoubtedly by skilled hands. During the banquet of Trimalchio, boys moved about under the tables and attended to the feet of the guests, doing this with special skill.

Perfume, which constituted an important factor in the toilet, consisted of fragrant salves or oils. The latter, which were fluid and, as at the present time, used in atomizers, were largely used as luxuries.

Roses, violets from Athens, spikenard, and henna blossoms from Egypt served as sources of perfume: these were used not only separately, but in mixtures, and the perfumers of that period were just as proud of certain fragrant compounds as those of the present time often are. They were valued according to their source or according to the firm which prepared them. The names of perfumers who excelled and whose manufactures commanded a big price have been preserved: Cosmus, Nicero, and Aurelian were the Atkinson and Lubin of that period. The manufacture of perfumes, at least that of oils and salves, was very much like that of the present age. Ointments and oils were impregnated with delicate odors by maceration; they were warmed in a water-bath and fresh flowers added several times; they were prepared exactly like the *huiles antiques* of the French perfumers. The ancients also were aware that certain very delicate odors required fortification with others of a more lasting quality to make them more permanent; oil of rose was mixed with andropogon, oil of lilies with calamus and myrrh. Alcohol was not known as such, but wine was impregnated with aromatics and this was employed by perfumers; this was used to prepare pomades. An old recipe of Dioscorides, in whose materia medica a great many superior prescriptions are found, gives an excellent basis for ointments: Deer or ox suet was melted with a little salt, after removal of all foreign particles, and then poured into pure water, which was changed frequently, the fat being cleansed by kneading. Then it was boiled repeatedly with fragrant wine until the original disagreeable

odor had disappeared. This basis for ointments corresponds to our Adeps benzoinatus. A great many oils were used, and these were prepared in other ways—bleaching in the sun, washing with water, etc. Almond oil from bitter almonds (metopium), olive oil, oil of ben, oil of sesame, nut oil, castor oil, and juniper oil were all known and employed in the preparation of perfumery.

As already stated, these scents were used liberally and, later on, even too profusely in a manner which would have been distasteful to us. It seems extraordinary to us to read of the guests of Trimalchio having been treated to fragrant oil so liberally that they were soaked with it, and of costly salves having been applied to the forehead so that they ran into the eyes; for we do not now hear of any one perfuming his guests. But we must not forget about the propensity of the ancients for anointing the body; and we should also remember that even at that time, ladies and gentlemen who were drowned in an excess of oils and perfumes were ridiculed. In addition, it may be stated that certain strong odors were preferred for men, and others of a fine delicate quality, or mixtures, were selected by women.

The various cosmetics used in the care of the mouth were very important. The brushing of the teeth and the removal of tartar belonged to cosmetic procedures as well as improving the teeth and drawing them. They also looked after the odor of the breath, and to improve this or to cover up some disagreeable odor, they were in the habit of employing mouthwashes prepared with saffron, roses, etc., or of chewing myrrh, mastich, fennel, or costly preparations corresponding to the perfumed cachous of the present day. Any disagreeable odor occasioned by food or drink was remedied in the same manner. Ladies and gentlemen were not satisfied with the remedies of the *ars ornatrix*, but not infrequently employed those of the *ars fucatrix*. White and red paint was used in the form of powder and of paste, especially white lead and chalk. For rouge, among other things, minium and carmine were employed; and for blacking the eyebrows, burnt ant eggs (Plinius) or soot was used. Frequently there were added to face pastes substances that were of value or were thought to be of value as cosmetics, just as is done to-day. A favorite remedy, the value of which must be acknowledged, was car-

bonate of soda; this was named "aphronitrum." Ovid gives recipes for such beautifying cosmetics, and also for others containing sal ammoniac.

Like our own beauties, the Roman women attached great importance to their natural or artificial coiffure and to hair ornaments. They used combs of wood (multifido buxus dente) or of ivory (morsu numerosi dentis eburno) or of tortoise-shell; the latter were, however, used chiefly as ornaments. They perfumed the hair with fragrant oil, used the curling-iron, and had these curls extend low down on to the forehead in front and hang down loosely behind, where at the part they were joined to an artificial chignon by means of richly-decorated wooden or golden pins. Finally a net, the color of which corresponded to the hair, was placed over all.

If in consequence of age, grief, or other causes the hair had lost its color, dyes were resorted to. A great many hair-dyes seem to have been used in Rome; among them there were some which are still in use, such as green nut-shells and acetate of lead. A recipe of Plinius directs that the latter shall be made by mixing leeches and vinegar together and allowing them to remain in a leaden vessel for two months; it seems, too, that the "plumbea Nicerotiana" belonged to this category. We are ignorant of the nature of other remedies, such as the "spheres of Matti" (coming from a part of Germany near Wiesbaden).

After the Roman had seen the blonde maidens of Germany, blonde and red hair came into style more and more, and efforts were made to bleach the hair. For this purpose strongly-alkaline soaps, especially the German (spuma batava), were used. This or some other hair-dye seem to have been especially deleterious; it greased the scalp and favored baldness. This served as a subject for satirists as much as the wigs which were worn not only on account of baldness, but also on account of desired color when this could not be imparted to natural hair. As blonde and red hair became fashionable, wigs of these colors, especially those made of German hair, became common and desirable.

As is usually the case, this bleaching, which originally was used by a few elegant ladies only, became exceedingly common and vulgar, so that finally it was a specialty with the *demi-monde.* Hair-dressers had another important cosmetic

occupation—epilation. Ladies had hair removed from the abdomen and men from the armpits. This was of greater importance than with us; for with few exceptions, hirsute appendages are only regarded as cosmetic errors when they occur upon the face, neck, or, in the case of women, on the arms. In Rome, where the left shoulder, arm, and armpit, together with the back of the neck and the breast, were always exposed, and the legs frequently bare, the removal of hair from these situations was absolutely necessary. At first this custom was prevalent with women only, but after a while men also resorted to the procedure. The razor was employed (novacula) for coarse hair, as for instance on the legs, or else pumice-stone was used in places of more limited extent, as for instance on the upper lips of women, around the nostrils; fine forceps were used on the eyebrows (volsellæ); finally vegetable materials were used, especially upon the face; among the latter class were psilothrum (Bryonia alba ?) and dropax (unknown); these seem to have been employed chiefly by women.

In addition to these remedies, the Roman women were acquainted with many other means of increasing their beauty. Thus they used the breast-band (maxillare) to diminish the size of a breast that was too large, and to retard its growth. This was the analogue of the bodice, which is intended to give the women of the present period support, the wearing of which is a custom which reminds one of the costume of the Bajadere Indians.

Taurino poteras pectus constringere tergo
Nam pellis mammas non capit ista tuas.—Mart. xiv., 66.
You might bind your breasts with the back of a steer,
For this leather band will not hold yours.

Fascia, crescentes dominæ compesce papillas,
Ut sit, quod capiat nostra tegatque manus.—Mart. xiv., 144.
Bind, restrain the growing breasts of women,
So that they may be grasped and covered by our hand.

Even beauty-plasters (splenia) were not unknown; they served partly to hide blemishes in the face, just as they are sometimes used at the present time, or else to add to beauty by making the brow resemble the firmament.

The subsequent periods do not present much literature which would enable us to judge of the advance of the knowledge of cosmetics. It is certain that this did not lag behind, since a people or a nation that makes strides in the possession of land and in culture, also progresses in the enjoyment of the luxuries of life.

The Arabians were the successors to the physicians of the post-classical period who are credited with special knowledge of cosmetics; they occupied themselves quite extensively with this subject, which was an evidence of the demand for such services. Four hundred years later, we still find cosmetic prescriptions in the works of French physicians: recipes of Rhazes (end of ninth and beginning of tenth century), of Avicenna (end of tenth and beginning of eleventh century), and of Mesuë (probably Mesuë the younger, eleventh century). Belonging to this period is a work which is very interesting to us, by the famous Trotula,[5] "De mulierum passionibus," and which also contains cosmetic prescriptions. Another work, "Practica Trotulæ mulieris Salernitanæ de curis mulierum," deals chiefly with this subject; and a third, also from Florence, is partly devoted to it, "Trotula in utilitatem mulierum et pro decoratione earum scilicet de facie et de vulva earum." The diseases of the skin of the face and cosmetic remedies are also spoken of in an anonymous work of the twelfth century of the Salernitan school, "De ægritudinum curatione."

The greatest surgeon of the middle ages, Guy de Chauliac, furnishes material for admiring his extensive knowledge of this subject in a chapter of his "Grande chirurgie."[6] We observe also that it was not beyond the province of so celebrated a physician to notice these minor affections of man. With the exception of a few prescriptions of a peculiar nature inherited from the ancients, all of his directions are excellent and many of them are still followed at the present time.

In the chapter "Pour embellir et faire bonne couleur" he recommended paste made from beans, wheat, rice, or almonds with milk; these were to be applied to the face over night. Lead and sublimate ointments were also recommended for the same purpose. The method of applying powder and paint is presented in an excellent manner: "La maniere de farder ou embellir est, que le visage soit premierement estuué puis soit laué avec du sauon destrempé en eau tiede." . . .

"Le visage estant essué, qu'on y applique vn des susdits vngnents et qu'on l'y laisse toute la nuict. Landemain soit laué avec eau de son, ou de violettes et que le visage demeure quelque peu de temps couuert d'vn drapeau. Puis si vous voulez donner couleur aux joues mouillez de l'eau d'alum, en laquelle ou ait destrempée vn peu de la ratisseures de bresil."

For the cure of facial blemishes there were recommended calcined tartar, litharge ointment, lait virginal made from litharge dissolved in vinegar and mixed with salt-water, and especially a paste recommended by Rhazes and Avicenna, prepared as follows: One drachm of mercury and three drachms of almonds are rubbed together until the mercury is no longer visible; then an equal amount of pulverized melon seeds is added and mixed. This paste was to be applied seven successive nights and washed off in the morning with lukewarm water.

Guy also paid attention to the hair. For cleansing, he recommended washing with egg or with soap, either soft (Sarrasin) or hard (François). To prevent the falling of the hair, myrrh and labdanum with vinegar and wine; this was to be followed by washing. Alopecia areata was treated with sulphur, euphorbium, staphisagria, and cantharidal oil—remedies which we are unable to improve upon five centuries later.

It need not be wondered at that there were some peculiar medicaments; the greater portion of these, however, were quite rational. An example of such a peculiar "mixtum compositum" is the following, which was recommended in alopecia: "Echini with their coverings, green galls, bitter almonds, bear's hair, adianthum, rattan root, fig-leaves, of each two drachms; rat fæces, one drachm soaked in vinegar; cedar-resin and bear's grease, sufficient to make a soft ointment."

In dyeing the hair, a wash of alum dissolved in lye was first employed. The women of Montpellier, the city in which Guy practised the longest, added lavender flowers and broom, and the Parisians added gentian, berberis root, and carthamas to this lye (undoubtedly for bleaching). To color the hair black, among other remedies, oil which had been mixed with lead in a leaden vessel was recommended (plumbea Nicerotiana!).

Five methods are mentioned for removing hair: Cutting, shaving, epilation with forceps or with the fingers, pitch, and

depilatories. Orpiment with lime is the only example mentioned in the last class; this was to remain on the skin as long as it took to say a *miserere;* after washing off, the skin was to be treated with oil of rose or white ointment.

The Renaissance period occasioned a stimulus among the petty arts of applying cosmetics. Giovanni Marinello, a physician who also wrote a very good book on obstetrics, published a treatise on "Cosmetics for Women"[7] which he dedicated to Signora Vittoria and Signora Isabella Palavicine. In the preface the author justifies his writing in quoting Ovid that one is but doing right and pleasing God in treating of the beauty which He had given and in trying to improve upon it by art.

At first general remedies are given: Perfumery for various purposes, aromatic baths to keep the skin youthful and fresh, and remedies which were supposed to make certain parts of the body stout and others thin. Medicines to prevent hyperidrosis and bromidrosis—myrtle leaves in wine or sweat-absorbing powders of roses, spike, and myrrh.

Among the general beautifying remedies are reckoned the powders and paints—cerussa of marble, cerussa of stag-horns, and litharge in vinegar—then also rouge. The custom of painting and powdering grew in style during this period, and not only the face, but also the neck and breasts were covered. Thus Cesare Vecellio, a nephew of Titian, writes: "It is easy to recognize the prostitutes who come to Venice from other places. They are very bold and show not only their face, but also a large part of their white-powdered breasts."

Pigmentation of the skin, scalding, freckles, and roughness of the skin of the face were treated with borax, alum, lead, and nitrate of silver; the last was mixed with hen's blood (Cotture o sufferse nate del feruore del sole, Lentigine, Macchie fatte del sole, La pelle grossa della faccia con quali modi si possa fare sottile, chiara e morbida). Solution of carbonate of potassium, lemon-juice, and powdered snake-root were also recommended for these defects. Marinello treated the cosmetic defects of the mouth, especially chapped and pale lips, in a very sensible manner—also the gums and teeth. Concerning offensive breath, he remarks that if this be due to retained particles of food, poor teeth, or diseases of the gums, it may be cured, but not in cases having a different etiology.

He also recommended remedies to cause large eyes to become small and small eyes to become large; belladonna is, however, omitted from the latter category, although it was sold in Venice under this name about this time.[8] The chapter on hair is very full. In treating falling out, he recommends rubbing with oil, then washing with acetosa (species of rumex containing tannic acid), and "mirobalanen" (also astringent). To promote the growth of hair, he speaks of dried and powdered frogs, lizards, etc.; remedies are also mentioned which are intended to make the hair long and soft and curly; also remedies for eyebrows and eyelashes. Hair is removed by lime and orpiment. Hair-dyes were important remedies at this time, especially the bleaches. Though black was also produced by iron, sal ammoniac, galls, and the various preparations of lead, and though hair was also dyed white and red, the principal color was blonde. The patrician women of Venice colored their hair as the Roman females had done; later on the prostitutes also dyed their hair. A long time afterward this style for bleaching hair pervaded France, though it never became as general there as it had been in Italy, where they had reached a degree of perfection in colors which, if portraits of that period can be believed, has not been equalled since (examples may be seen among the portraits of women by Palma Vecchio in the Belvedere of Vienna); the wonderfully warm tone with beautiful reflexes, *filo d'oro*, or the less admired ash-blonde is really incomparably beautiful. Recipes for these dyes existed in large numbers, and they probably accomplished their purpose, though we are not quite clear on this point. Marinello recommends chiefly ashes of vines, an infusion of lupine made with saltpetre, or alum and ashes, saffron and madder or burned wine-sediment with spermaceti or oxide of lead and chalk and lime. In "Recettario della Contessa Nani" there is a prescription calling for two pounds of alum, six ounces of black sulphur, and four ounces of honey —added to water and distilled. Fioravanti advised washes of infusions of silk-dyes in which calcined tartar was dissolved; or a wash with soap followed by the use of a mixture of strong lye to which tartar, ivy, and barley had been added. The application of these remedies was not a very simple one. Cesare Vecellio describes how ladies who wished to bleach their hair had to spend their time upon the terrace-tops of houses;

the hair was washed and then soaked by repeated combing with the coloring fluid. During all this time, and for hours afterward until the hair was thoroughly dried, they were compelled to sit in the sun so as to fix the color. On this point all authors agree. Alpinus (1592) also mentions it in connection with the employment of henna; he recommends this to ladies, pro deaurandis capillis, as something harmless. To protect the complexion during this lengthy exposure in the sun, they wore peculiar hats without crowns and with wide brims; the hair was allowed to fall over the brim from above.[9]

At this time the endeavor to improve feminine beauty was not confined to toilet specialists, but was part of the work of physicians and artists. The latter were not averse to painting according to all the rules of art.

Even Giov. Baptista Porta,[10] a prominent scientist and one of the most noted physicists of his day, did not consider it beneath him to give quite extensive formulæ for beautifying remedies. He shows a familiarity with the older authors and cites Dioscorides, Plinius, and later Trotula; but also gives the results of his own experience. These directions are entirely similar to those of Marinello: some are remarkable on account of being rational, others because they are so singular.

To whiten the face, all things that were white were considered of value. Thus snails, because they leave a silver line behind them; pearls dissolved in acids and rotted in manure produce a brilliant oil which was recommended as one of the best things for the face; carbonate of lead; sublimate. The face was to be cleansed first, so as to take the coating easily. To make the face soft and pliable, he prescribed milk, a paste of milk and bread, and gelatin. As rouge for the face, sandalwood in vinegar and alum, dyer's weed, and anchusa were recommended. Sunburn, especially in travelling, was to be guarded against by the use of a paste of starch and white of egg; this was to be washed off with barley-water after the patient had arrived. Facial blemishes required daily inunction with oil of tartar for ten days, the face remaining unwashed in the mean while; acetate of copper, ammoniated copper, and corrosive sublimate were also used for this purpose. Moles were removed with aqua regis or with Æliani's "leonis adeps:" "Within the skin inclosing the testicles is a

soft and delicate piece of flesh shaped like a grasshopper;" this was rubbed up into a salve with oil of rose. Other moles were treated with mercury dissolved in red wine. Wrinkles were treated with water distilled with phaseolus, verbascum, or polygonum in Grecian wine with lemons, or pastes made with deer-horn, white lead, sal ammoniac, myrrh, incense, and honey. Tooth-pastes were made from toasted bread with salt and honey. For keeping the hands white and soft, almonds, cembra-kernels, melon or pumpkin seeds were used instead of soap, and then the hands were smeared with salves made of butter, wax, and sweet almond oil and covered with gloves; these gloves were washed in Grecian wine and then soaked in this salve before being used. The offensive odor from the axilla was relieved by the use of powdered myrtle-blossoms or washing with solutions of alum or of acetate of lead. Excessive development of the breasts was treated with applications of conium; soft and hanging breasts with white clay, galls, mastich, and incense. Hair-invigorators were honey and oil, singeing with heated nutshells and horse-grease; there were well-known depilatories—epilation—and then to prevent the regrowth of hair, hyoscyamus, cicuta, ivy, etc. The hair-dyes were well known—acetate of lead and acorns in wine for black; lye, alum, and tartar for blonde; to produce the latter color, there was also recommended washing with lye of ashes and bleaching in the sun; finally also the vapor of sulphur placed upon live coals; for red hair, strange to say, alcanna boiled in lye.

About this time Italy was the blessed country. Artists and merchants took from it virtues and vices, the customs of a refined mode of life, and brought these to Germany and France; and young men and women did not hesitate to adopt at home what had been style in Italy, though this was modified a little so as to prevent too great a clashing with home ideas. This did not, however, prevent its progress, and the young lady of the sixteenth century could not be without toilet-waters of wine, primroses, dittany, and especially of lemon-juice, upon her toilet-table; also fine flour from mustard-seeds for rubbing the hands. They made use of a fine napkin or marten's fur to wipe off the perspiration, and did not disdain to use rouge made from snakeroot.

These minor arts were carried into France by Catharine

de Medicis and by Marguerite de Valois. The latter is credited with the introduction of blonde hair-dye, the former with that of powder and rouge. All these came prominently into use in the beginning of the seventeenth century, and from this time to the middle of the following century their use increased very markedly. During the seventeenth century ladies used powder, "blanc d'Espagne," and rouge, "l'espagnol vermillon," and numerous toilet-waters—some perfumed, like "eau d'ange," "eau de Chypre"—some emulsionized, such as "eau de concombre," "eau de fèves"—also meat-juice and lemon-juice. They dyed the hair blonde, in Venetian style; they used curling-irons; they wore the hair cut off close on the forehead (as is shown in a picture by Racinet) and pasted down—just as was done here until recently.

Though the use of these remedies at this time was not so very extensive, there was considerable ridicule bestowed upon it and attention was already called to the deleterious effects. Thus Labruyère relates that at this time (middle of seventeenth century) women were spoiled by paints and cosmetics, in painting lips, cheeks, eyebrows, shoulders, and even the exposed breasts. Powder, used as early as 1593, was employed even more upon the skin than upon the head. At this period also ladies began to pay attention to coiffure, and hair-dressers became of such importance t t they took the most unheard-of liberties. Sieur Champagne gives an account of one of the most celebrated among them, who left the hair of a lady undressed without any reason; in another instance he refused to finish his work until the lady had kissed him, etc.; notwithstanding all this, he accumulated quite a fortune. Ladies also wore plain masks or masks soaked in irritating fluids overnight, so as to stimulate the complexion. This custom also emanated from Italy; originally, though, it was intended simply to shield the face against the sun.

> "But since she did neglect her looking-glass
> And threw her sun-expelling mask away,
> The air hath starv'd the roses in her cheeks."
> —Shakespeare: The Two Gentlemen of Verona, IV., 4.

In the early part of the seventeenth century the reign of the *mouche*—the beauty-spot—began and increased to such an extent immediately that in 1634 an esteemed man asked in all seriousness whether women might wear more than three

mouches. Beauty-spots were supposed to make the eye alluring and to enhance the beauty of the face—they were supposed to be irresistible; the gallant might be ever so indifferent and proud—"enfin la mouche le pique." These decorations were at their height at the time of the Allonge wigs; the material was black silk, satin, or taffeta. At first they were worn, just as they had been by the Romans, to cover blemishes, and they were then small and shaped according to the spot they were to hide; but later they had all shapes—circles, stars, semilunar, silhouettes, peculiar figures. A certain Duchess of Newcastle wore upon her forehead one of these beauty-spots representing a coach and four horses, a driver and footman. The form was not a matter of indifference; a round spot was appropriate for the chin, a star-shaped spot on the cheek, semilunar ones beneath the eyes; in the depression formed in laughing, there belonged one called "*l'enjouée,*" at the side of the lips "*la coquette*" (also called *précieuse* and *friponne*); upon the forehead "*la majestueuse,*" and a large plaster called "*enseigne du mal de dents*" upon the right temple. One day the beautiful Mme. Cazes appeared with such a beauty-spot surrounded by diamonds. These various forms also had special purposes—the long one was for balls; the large, broad one for court; the small, coquettish one was intended for the street, the tête-à-tête, or for the banquet. The most important of them all was the one worn at the angle of the eye, the "*assassine.*"

"You may have your hair dressed as you wish,
With curls falling upon the breast;
Nothing but the beloved assassine,
Will rouse the love of men." [11]

The number of them constantly increased; six, twelve, fifteen, and even more were worn, according to fancy. At the end of the seventeenth and beginning of the eighteenth century they were absolutely indispensable to the elegant woman.[12]

This entire period was a precious one for toilet arts. It is wonderful that rouge and all such toilet aids were tolerated, though it was just at this time that clearness of complexion, "*teint de couvent,*" was valued so highly that even old ladies wore masks to shield the face from inclement weather. There were hundreds of pastes, essences, beautifying liquids, white

balsams, waters to redden the skin of the face—others to whiten it—others to soften it—to preserve the delicate teint of lean persons—to restore the complexion of the twentieth year, and waters for blemishes, freckles, wrinkles, etc. Then there were *mouchoirs de Venus* and bands impregnated with wax to cleanse and polish the skin of the brow. Gold-leaf was warmed in a lemon at the fire—a preparation intended to give an extraordinary polish to the face (un lustre surnaturel). There were a great many recipes, salves, and pots for the hair, nails, and teeth. The paints were of the most importance—chemical white—blue for veins—red, vegetable or mineral, or scarlet. The application of rouge was no little task; it was not only necessary to put it on, but it was expected to be expressive: "Le grand point est d'avoir un rouge, qui dise quelque chose." It was expected to be a distinguishing feature of the wearer: a lady of society did not wear the rouge of the court lady; that of a peasant woman differed from either, as did also that of a prostitute; these merely had a trace of red: "Il n'est qu'un soupçon de rouge, une nuance imperceptible." On the other hand, a very intense red was worn at court, which was still more pronounced on the day of presentation; it was *rouge d'Espagne* and *rouge de Portugal en tasse,* and though this scarlet made all surroundings yellow, ladies wore it so as not to appear pale.

It seems almost incredible that they used violet color for a week and then changed to red, changing off with *rouge de serkis.*

Even during the night a light red (*un demi-rouge*) was applied; even the youngest girls had to apply rouge, for that was style. Eyebrows and eyelashes were colored with antimony, and thus apparently the eyes were lengthened and made to resemble the Orientals or even the Chinese. They powdered the hair—their own as well as the false, for the women of 1750 began to wear wigs and braids. This was done partly to dry the hair after dressing, partly for decoration. White, gray, red, and fire-red powder was in use. The entire cosmetic art was known and employed. Men even epilated all over the body: "Dans le grand, le très grand monde peut-être seulement chez les princes un usage conservé de l'ancienne galanterie exigeait du marié qu'il n'entrât dans le lit de sa femme que le corps complètement épilé. C'est ainsi que M. le duc

d'Orléans au témoignage de M. de Valençay qui lui donna la chemise, se présenta dans le lit de Mme. de Montesson."

Men took part in these accomplishments in other ways. They decorated themselves and improved their appearance artificially so as to look their best: "Et pour faire l'illusion complète . . . il en est qui . . . se griment, qui se plâtrent, qui se dépoudrent les cheveux, qui se pâlissent, en se privant du vin . . . avec de la gomme arabique délayée ils se font sur les joues des traces des larmes mal essuyées."

This period, which the brothers Goncourt [18] describe so well, did not last long. In 1760 there was a return to nature, or rather to artificial nature. Ladies wore their hair free, combed almost in antique style. The *teint de couvent* was as highly prized as before; but those who did not possess it did not use *eau de chair*, but ordinary water, to preserve the delicate complexion of a thin person. Of course rouge was still applied, because the dull, pale complexion was not fancied any longer; they preferred the natural red. The very voluminous use of powder on the hair also disappeared. Ladies found that paint made the features coarse and hard, and that it made the faces of blondes insipid and those of brunettes darker than natural. They then employed only a trace of powder, to which was added only a small quantity of blonde or red powder. The application of face-powder has remained like this during the nineteenth century. Even though there was now and then a sort of return—the gold and crystal powder used in the sixties may be remembered—this was always transient, moderate, and not excessive.

A real progress during the latter half of the sixteenth century is represented by the bath. As far as we can tell from literature and from works of art, the use of the bath at home died with the Romans. Even the public baths in regions of mineral springs were given up later or were forbidden by the church. Hieronymus forbade baths of all sorts after childhood; they were revived during the Crusades, when the custom was again learned from the Orientals. A domestic bath in the fourteenth century meant a very thorough wash; bathtubs of that period were merely large basins; baths were taken in castles, etc., in lukewarm water. Since they took their baths, eleganty attired, merely bathing their feet, they could do this and frequently did, in company.[14] During the end

of the sixteenth and beginning of the seventeenth centuries, the public baths were interdicted by religious authorities and were shunned on account of the fear of syphilis. The few bath-tubs which barbers had in their rear rooms were intended chiefly for invalids. Ladies could not patronize these baths. Even toward the end of the seventeenth century, when bath cabinets were again put in houses, these were not bath-tubs in the sense which we use the term to-day; they were merely copper basins in which, with some care, the feet could be bathed.[15] These baths were gradually elaborated, and finally, in the latter half of the eighteenth century, they constituted one of the great luxuries of elegant houses. These bath tubs were rather long and wide, but shallow, with rounded bottom, and were just about right for a "half-bath" (bain-nonne à la Dauphine Marie Antoinette). They were intended especially for compound cosmetic baths containing milk and almond-paste, eau de chair, and other remedies.

At the end of the eighteenth century the majority of beautifying remedies had been discarded; the Parisian ladies and those of Germany no longer used powder and rouge. Simple hygienic observances were recommended, such as the evening bath, rubbing with bean-meal, and covering the face with cloths soaked in wine, alum, and gelatin. In 1788 an unknown German physician cautioned the people against the use of any cosmetics, even those obtained from Paris, and recommended baths as the only effective cosmetic.[16]

The style of our century has changed much more rapidly than that of the preceding century. But cosmetic has remained the same; the excesses have been dropped; a certain number of minor toilet accomplishments remain, and these seem more rational through the progress made in hygiene and the gradual knowledge of this by the public. Another portion has become the exclusive property of the physician, who is able to improve upon certain errors of nature through his knowledge of dermatology. In this respect the laity, and especially women, have become superstitious and expect the most wonderful remedies; this is as it always was.

The Romans may have cleansed their teeth with urine sent from Spain,[17] so as to keep them nice; but this appetizing remedy is still used to promote the growth of hair. Poppæa attributed her wonderful freshness of complexion to the use of

milk from asses; Empress Josephine, the wife of Napoleon I., thought her celebrated complexion due to the use of milk which was poured boiling over violets.

In most of the proceedings which the physician undertakes upon the surface of the body, the so-called cosmetic relations cannot be ignored. There are a great many precautions and rules for the preservation of beauty and symmetry; these, though not directly connected with cosmetic, have a certain relation to it. Cases occur quite frequently in which persons suffer from disorders that are not particularly grave, in which the physician can only get them to undergo the necessary treatment by reminding them of certain cosmetic blemishes which will result in the absence of such treatment. Inunction-cures and Weir-Mitchell's cure are possibly cosmetic proceedings, if regarded in this sense. In the same way, the majority of cases of curvatures of the spine and of flat-foot which are scarcely perceptible to the unskilled eye are object for rational cosmetic treatment. Still such cases are considered quite removed from what we regard as belonging to cosmetics, because there are, as a rule, deeply-seated changes. How necessary is the knowledge of the folds of the skin or of the growth of hair to the physician, so that he may make his incisions in minor and major operations accordingly! The patient will be all the more grateful to the physician who operates so that the resulting scars shall be imperceptible. A number of physicians vaccinate on the lower extremity, especially the leg, instead of on the arm. When we see the disfiguring, large vacination-scar upon the faultless arm of a charming young girl, we appreciate this respect for human vanity. Many operations have for their sole object the establishment of some cosmetic improvement; this is often the case when the operation can no longer re-establish a lost function.

From the preceding it is evident how greatly the decisions of physicians must be influenced by cosmetic considerations. Were these pages to consider cosmetics in such a boundless sense, the province would be far too extensive. In the following pages, cosmetics will only be considered in the customary sense—we shall consider only the skin, hair, nails, and mouth, and the cosmetic remedies for these parts.

CHAPTER II.

THE SKIN.

In its normal condition the human skin is smooth: it is peculiarly soft to the touch and has a characteristic lustre. The skin of a healthy Caucasian is in general of a uniform pale chamois color: it varies from a delicate, almost white, yellowish-rose to the peculiar brownish-yellow suggesting bronze of the Spanish, the Italians, and the southern Europeans generally. Particular portions of the surface of the body possess a color differing somewhat from the rest. Thus the cheeks and the finger-knuckles have usually a lively red tone; the portions of the body exposed to the influences of the air, the light, and the atmosphere—that is, the face, the neck, and the hands—are of a darker tone. Apart from these influences the skin of the nipples and of the genitalia is dark. The skin does not appear smooth to the eye, but is provided with a great number of partly parallel, partly intersecting lines. Finally, the skin possesses a certain motility and elasticity.

These properties of the skin are due to its peculiar structure. Its softness, often compared to that of velvet, is to be ascribed to the furrows and elevations made by the lines just mentioned, which latter correspond in direction to the cleft lines of Langer. Besides this, the softness of the skin is due to its hairs, and especially to those which, as lanugo—wool hair—cover the so-called unhaired places. There are also in the skin small hollows or pores, which represent the openings of the hair-follicles and of the sebaceous and sweat glands. Altogether the skin is about one-tenth of an inch thick, and consists of the corium and the overlying epidermis.

The corium is made up of a dense regular tissue of elastic fibres, and under this a fibrillar connective tissue, in whose meshes, as well as in the cellular subcutaneous tissue beneath it, there is a considerable amount of fatty tissue. The skin owes to the former its pleasing roundness, to the latter its

elasticity. The corium is united with the superficial portion of the skin by the papillæ, which fill out corresponding hollows in the other. These papillæ contain either capillary networks or nervous apparatus. The rosy tint of the skin is produced by the fine vascular network. The bluish color of many parts of the skin and of many individuals does not come from the capillaries, but from the larger and smaller veins which shimmer through the exceedingly thin skin of the parts and cause them to appear blue.

The superficial layer or epidermis consists itself of two layers, the rete Malpighi or mucous layer, and the horny layer or stratum corneum. The rete Malpighi sends from its lower surface cones which fit into the hollows of the corium. More superficially there are cells which in normal persons of the white races are but slightly pigmented, but which in certain portions of the body and in the colored races contain quantities of brown pigment. On the amount of this pigment, or rather on the amount of this and on the capillary network shining through it, depends the color of the normal skin. Still nearer the surface are closely united prickle cells whose function is not yet clearly understood, and finally the superficial layer is the stratum corneum, which consists of cells becoming ever smoother and dryer and more horny. This superficial layer is continually being cast off and replaced from below. The rete cells gradually lose their character and become first granular (layer of granular cells). The granules (keratohyalin, Waldeyer) are the first expression of the horny change. The second process is the appearance of a transition layer, the stratum lucidum (Oehl). The casting off of the epidermic scales is normally barely perceptible; it can occur under mechanical irritation or friction; it may be hastened or increased by baths. The cast-off scales are chemically similar to horny matter, they swell in alkalies, etc. The epidermis differs in thickness in different parts of the body; it is thin on the lips, thinner on the flexor than on the extensor surfaces of the body, it is thickest on the palms of the hands and the soles of the feet.

The lustre of the skin and its specific moisture are caused by the secretion of its proper glands. The sebaceous glands are simple acinous glands which, in the case of the coarser hairs, form appendages to the follicle. In some parts of the body,

as the labia minora, glans, prepuce, and the red border of the lips, the sebaceous glands stand in no relation to the hairs. They are completely wanting in the palms and soles. The largest are in the nose and lips. Their secretion is first fluid, but during its stagnation in the duct it comes to be a white, tallow-like mass, which on pressure emerges with a wormy motion. It contains fatty acids, soaps, cholesterin, albumin, and salts, among which latter insoluble earthy phosphates predominate.

The sweat-glands are convoluted tubes, which are largest and most numerous in the palms, soles, and axillæ, sparser in the back. They are entirely wanting in the glans, the prepuce, and the border of the lips. They open into the furrows between the papillæ, at regular distances in the pulp of the fingers, in longitudinal rows on the palms and soles. Their secretion, the sweat, is mostly of alkaline reaction, but often acid from the presence of the fatty acids. It is generally colorless, somewhat cloudy, of salty taste and peculiar smell, varying in different parts of the body according to the volatile fatty acids present. It contains neutral fats, cholesterin, volatile fatty acids, traces of albumin and of urates, and some salts, mostly sodium chloride.

The human skin is normal when, fulfilling all anatomical and physiological requirements, it is smooth, soft, glossy, and moist, delicately colored, elastic and tense. Still it may not fulfil all the æsthetic and individual requirements. These requirements, governed by taste and fashion, are different in different localities and at different times; the individual requirements are always the more exacting.

The hardest of these to fulfil is the common longing for perpetual youth. Besides being normal, the skin must, at least in its exposed portions, be youthfully full, tense, fresh, and fragrant. At any rate, no anomalies, even if they be so slight as not to be pathological, can be present. These anomalies are as regards color, lustre, smoothness, the covering with hair, the scaling off of the epidermis, the secretion of the glands, and finally the elasticity and thickness.

Changes in the color of the skin depend either on an excess of the pigment existing in the rete Malpighi and in the corium, or on a diminution or entire want of pigment. Or it may not depend on the normally present pigment, but on the increased

or decreased filling of the vascular network, and at times on the presence of a pigment coming from other parts of the body or from without. The overfilling of the capillaries causes the bright red cheeks of young girls ; the general diminished quantity of the blood, or especially the loss of blood, causes paleness. This is more intense when there is a lack of red blood-corpuscles or of blood-coloring matter, and becomes then the cheesy-white or greenish-gray chlorotic color. Finally, anomalies in the circulatory system, venous congestion, may produce that bluish-violet color which is known as cyanosis. An increased amount of blood in the vessels of the skin and a healthy red color even without pigmentation may be caused by living in the open air and free light with corresponding food; in confined places the complexion becomes pale from the want of air, just as do the leaves of plants.

Cosmetic therapy in these cases limits itself to the regulation of the manner of living; with anæmic and chlorotic persons, as well as with patients who suffer from disturbances of circulation, the treatment is only that usually employed in these conditions. Pale individuals may increase their color by cold baths and light stimulation of the skin. In many persons one sees hyperæmia or anæmia localized to a small region, which depends on a dilatation or contraction of the vessels of the skin through nervous influences—angiospastic and paralytic hyperæmia and anæmia.[18] This may affect one-half of the body, one extremity, a finger (erythromelalgia), one-half of the face, the nose, etc., and is found, especially in connection with other nervous symptoms, in neurasthenic and hysterical patients. Ergotin, salts of bromine, sodii salicylas, antipyrine, and especially the constant and faradic current, are recommended for this condition, and are often of service. Arsenic in the form of the Asiatic pills has been useful to me in a number of cases. To this form belongs also the sudden paling or reddening of many portions of the skin under the influence of moderately increased or lowered temperature, which condition also is to be treated on general indications.

Changes in the color of the skin which are caused by pigment are either congenital or acquired. They may appear as discrete spots or be extended over large surfaces. The congenital pigment patches are called nævi. They vary in color from light brown to dark brown or black, have a smooth sur-

face often covered with lanugo, nævus spilus; or warty with thick brush-like hairs, nævus pilosus; or finally in the form of flat or prominent tumors, nævus molluscifornis. They are permanent, and occasionally. as in pregnancy, change their color. Of the acquired, the most important are the lentigines and ephelides, freckles. The former are spots varying from yellowish to blackish-brown, lentil-sized or smaller, round and often elevated, which appear on different parts of the body and are permanent. While a single small black lentigo may add a certain charm to a young girl's face, they may become very unsightly when they increase in size and number, as is often the case. Face, neck, and trunk may be covered with lentigines which have developed into warts. Although they commonly last to old age, cases are found in which a great number of the spots or warts disappear spontaneously without leaving a trace. The ephelides are more sure to disappear with increasing age. These are much paler, yellow or yellowish brown, frequently pigmented irregularly: their form is round, but frequently irregularly notched. They are found most frequently on the alæ of the nose, the cheeks, and the forehead, but more numerously on the rest of the body. Freckles also often reach above the level of the skin. They no not owe their origin to the sun, as their distribution over clothed parts of the body shows; still the season has a certain influence on their color, as it has on other skin diseases. They become pale in winter and often vanish, to become again dark in the spring. They are found both in brunettes and in blondes, but are more frequent and intense in persons with a clear, transparent complexion, most marked in persons with red hair, and do not appear before the sixth or seventh year.

The more diffuse pigmentations are called chloasmata. Such chloasmata are often symptoms accompanying many chronic diseases and certain anomalies of internal organs, especially diseases of the uterus and its adnexa, and chronic disturbances of digestion, also occurring in hysterical women and in viragos, and often during pregnancy. In many cachexias, more or less circumscribed, yellowish-brown or dark brown patches appear chiefly on the forehead, on the upper lip or elsewhere on the face. From their color they are called chloasma hepaticum, liver spots; and since they appear with female sexual diseases, they are called chloasma uterinum.

It has not been proven that these spots have any causal connection with the diseases mentioned; this belief would seem to have arisen from the fact that they disappear when the other disease is properly treated. The fact that many chloasmata uterina disappear after delivery or after the climacteric period also supports this belief. However, they cannot be with certainty referred to these affections any more than they can be brought into direct connection with liver diseases.

Chloasmata appear also after irritation of the skin. This may be either of a traumatic or a chemical nature, or may consist entirely in a too high or too low temperature. The effect, however, is constantly the same, the skin becomes hyperæmic, in greater or less degree inflamed, and pigment is deposited at the affected spot. The longer the condition of irritation continues, the older the pigmentation becomes, the slower will be the resorption. After chemical irritation the chloasma toxicum produced may last for the patient's lifetime. Such toxic chloasmata are produced by sinapisms, emplastrum cantharidis, emplastrum mezerei and croton oil, if the irritation of the skin be continued until vesicles are produced. If the application of such remedies continue only until redness of the skin be produced, no pigmentation occurs. These remedies cannot be avoided in practice, and the physician can only see that they are not applied to portions of the skin which are commonly exposed.

As chloasma traumaticum are designated those discolorations of the skin which are caused by continued scratching, either in diseases accompanied by itching or in habitual uncleanliness of the body (vermin). Of special importance cosmetically are the discolorations that arise in those parts of the body which are subjected to continued pressure. Pressure from the natural dress may cause such discolorations on the shoulders, the waist, and the legs just above or below the knees. The discolorations correspond exactly to the parts compressed or are somewhat broader, and are gray, yellowish-brown, or dark brown.

Under the influence of high or low temperature and of wind arises the chloasma caloricum, that peculiar red or reddish-brown discoloration of the face, the neck, and all exposed parts of the body which is called tanning. Pigmentation of this sort is seen mostly in individuals who pass much time in

the open air, as hunters, soldiers, and sailors, or in persons who are exposed to the light and wind for a short time, as tourists, bicyclists, oarsmen, etc. Chlorotic persons tan less easily than healthy persons; even they finally become pigmented, however. It cannot be maintained that tanning is exactly beneficial to the bodily health.

Those abnormal discolorations of the skin which are caused by certain organic diseases, such as morbus Addisoni and icterus, would never be the object of cosmetic treatment. I shall merely remark here that after the cure of the disease which has caused the icterus, the biliary coloring matter deposited in all the layers of the skin gradually disappears. In Addison's disease, however, one may expect neither the cure of the disease nor the resorption of the pigment, whose origin and nature are still under discussion.

Further should be mentioned the discoloration of the skin from foreign bodies. Silver given internally may get into the skin, the silver salts being absorbed, deposited in some soluble form in the tissues, and there being reduced to metallic silver; or it may be introduced intentionally or unintentionally into the cutis. These bodies may be simply dark or be colored; in the first case they appear blue through the epidermis; in the second case somewhat less intense in color. Such discolorations may arise unintentionally through the explosion of gunpowder. They are produced intentionally by tattooing. These pretended decorations which soldiers, sailors, and laborers have put on their bodies partly from wantonness, partly from superstition, are made by pricking the skin with needles and then rubbing in the color. The needles themselves are often dipped in the color, or a paste containing this may be previously rubbed on the skin, so that the needle becomes charged for each prick. Carbon, gunpowder, cinnabar, and indigo are the coloring matters most used. The most frequent figures in our race are names, dates, hearts, crosses, and anchors (faith, hope, and charity); in other races complicated and often artistically-drawn ornaments. The attempts, by tattooing unpigmented portions of the skin, to produce a color similar to the normal, have not been very successful, chiefly because sufficient pains were not taken to get the proper color mixture. Where it is a question of intense color, as after plastic operations on the lips, cinnabar gives a satisfactory result.

An abnormal color of the skin may be due to the lack of pigment, either congenital or acquired. The former is called albinismus, which when total could hardly be the object of cosmetic treatment. A partial albinismus is rare in the Caucasian race, and its treatment is the same as that of the acquired loss of pigment, leucoderma. This is either idiopathic or secondary. The first sort, vitiligo, shows larger or smaller circumscribed pale spots about which the surrounding skin is darker, coming on without a recognized cause. The discoloration may remain stationary, or the spots may extend so that finally they occupy the greater portion of the skin. The cause of vitiligo is of little interest and is altogether unknown; one method of development should be noticed, and that is the one in consequence of pigment hypertrophies in the neighborhood. Thus in the discoloration from pressure of the clothing, etc., described as chloasma traumaticum, central or peripherally-located decolorations often appear, which either remain localized or in time cover the whole extent of the chloasmata and become then surrounded by more intensely pigmented skin. In consequence also of other forms of trauma, such as burning, ulcers, stretching of the skin, and following emaciation after obesity, ascites, and pregnancy, discolorations similar to vitiligo are observed. No difference exists between all these pigment atrophies as regards treatment.

The treatment of discoloration caused by increase of pigment comes within our sphere. The true pigmentary nævi can be removed only by surgical treatment, by means of the knife or of strong caustics such as Vienna paste, hydrargyri chloridum corrosivum, and hydrargyri iodidum rubrum, or of the cautery; when they are extensive or when combined with sarcoma, this treatment should not be used, and if they are situated on exposed parts, there is nothing to be done except to conceal them by cosmetics .

Lentigines when very numerous may be treated in the same manner as the ephelides. To cure these it is necessary to destroy the skin down to the rete Malpighi in which the pigment is deposited. We employ either agents which cause swelling and exfoliation of the skin, such as alkalies (soap), borax, weak acids, and sulphur, or agents which cause a deep inflammation of the skin, such as concentrated mineral acids, mustard oil, croton oil, mezereum, cantharides, pepper, vera-

trine, iodine, and mercuric salts. The first-mentioned of these agents causing inflammation may themselves cause pigment hypertrophy and should not be used, although continually recommended. Plants containing acids and ethereal oils have long been used for this purpose. A paste composed of vinegar, honey, and bitteral monds has been recommended, also an infusion of radish in whey, also the application of slices of lemon, and under some circumstances these are successful. These act slowly, as do also the following agents: soap applications with acidum boricum or borax, washing with spiritus saponatus kalinis, pencilling with dilute acids, as sulphuric acid; acidum salicylicum and veratrine act more quickly, as does also hydrargyri chloridum corrosivum in 0.5–1% solution, and white precipitate in the shape of the well-known face pomade. The one-per-cent sublimate solutions may be harmful, even dangerous, when used in the ordinary manner for the rapid removal of extensive pigment spots. Here the skin is covered with a number of layers of linen which are kept moist with the solution for hours at a time, the patient lying down. One large or several small vesicles are thus produced, which are opened. An indifferent powder is then sprinkled on the skin, and after eight days the crusts exfoliate and the underlying skin is white and unpigmented. This method is similar to that of the French, which consists in the energetic pencilling of the pigment spots with a concentrated solution of iodine in iodide of potassium. To protect the surrounding skin, it is recommended to pencil it with a thick solution of gum. In a similar manner may be used tincture of iodine, and sulphur pastes or soap used as an application, and under this treatment the epidermis is raised in vesicles and cast off together with the pigment. The spot may also be covered with a plaster of acidum salicylicum, which acts in the same manner.

In using these agents, care is to be taken that no eczema be produced, and that the dermatitis brought on be properly treated. Applications of plumbi acetas or unguentum borici were formerly used, salves and powders then being applied to the reddened and exfoliating skin. To show how many agents may be of use, James speaks of a French marquise who went to her country-house every fall and rubbed her face with green nut hulls. Her face became at first the ordinary black color and then gradually exfoliated, leaving the skin

entirely free from freckles and pigment spots. This condition lasted only to the following May. All these agents indeed have but a temporary effect. The pigmentation usually returns.

As we have seen, it is possible to get at least a temporary improvement in cases of over-pigmentation; this is, however, not the case when there is a lack of pigment. Those agents which inflame the skin cause a darker coloring of unpigmented parts, but this is not permanent, and is not of the natural color of the skin. Tattooing has the disadvantage, that a color mixture corresponding to the normal color of the skin has not been found. When there is a want of pigment, or especially a progressive pigment atrophy, it is recommended to decolorize, by one of the methods given, the intervening pigmented patches, which are sometimes dark, pigmented, and always appear so by contrast.

The gloss of the skin may be increased or decreased. The skin shines when tensely stretched, or when swollen by inflammatory products or exudations which have occurred in the corium, or when serous fluids infiltrating the subcutaneous tissue, distend it excessively. In young, healthy individuals having a considerable amount of subcutaneous fat, the skin is more shiny than in older or in emaciated persons. In this case not only the tension and elasticity of the skin is diminished, but its peculiar lustre as well; and the skin becomes dull, faded, and flabby, and since the color also undergoes a change, it becomes sallow and earthy. The lustre of the skin is decreased by visible exfoliation, and increased by hyper-secretion of the sebaceous glands. Finally, there is another change in lustre to be mentioned. This is the peculiar shining appearance caused by atrophy of the skin. The most striking are those partial atrophies of the skin of the abdomen which are called cicatrices of pregnancy. Similar to these are the ruptures of the subcutaneous connective tissue of the thighs and buttocks after pregnancy or obesity. Finally, we should mention here the traumata of the skin and the localized atrophies caused by the separation of the deeper layers of the corium under the normal epidermis. The pressure of infiltrated tissues after chronic inflammations of the skin may act as a trauma, and cause an atrophy with peculiar changes in the lustre of the skin. This is found espe-

many after chronic eczema, recurring facial erysipelas, etc. It is often hard to decide whether a chronic eczema or a nervous affection may have been the cause of this atrophy and of this waxy appearance.

Therapeutics are powerless against these changes, and the lustre can only be toned down by powders and cosmetics. These parts, however, are so smooth that many powders do not adhere to them, and here fatty powders and fatty cosmetics must be used. If the lustre be lost in consequence of severe illness or premature old age, much may be accomplished by proper treatment of the skin, and especially by the methodic inunctions of fat.

The smoothness of the skin, which is often mistaken for the lustre, is brought about by a number of factors as above mentioned. These are the thickness and tension of the skin, the degree of its adherence to the underlying tissues, its furrows and depressions, its sebaceous secretion, and the slight exfoliation of epidermis. The two latter factors will be treated of later. These atrophies of which we have spoken, when associated with considerable exfoliation, may cause a striking smoothness of the skin. Of importance are the furrows and wrinkles which time engraves in the skin. These are the most undeniable sign of beginning old age. Neither general diseases nor skin affections produce wrinkles of this sort, which appear in greatest number on those parts of the body which are most likely to be noticed and which are the hardest to conceal. These are hundreds of small folds crossing each other in every direction, at first very shallow and becoming later veritable furrows over one-twentieth of an inch in depth. If the skin have a delicate tint, it may still have a youthful appearance, seen from the distance; the deception vanishes, however, on nearer approach. The formation of these folds and wrinkles depends on the loosening of the connections of the skin, on the disappearance of the subcutaneous fat and connective tissue, further on the flattening of the papillæ. They begin first on the neck just below the ear, pass forward to the chin, and finally occupy more or less the entire face. The region of the outer canthus of the eye shows especially converging folds. Apart from these wrinkles of age, the skin of the face becomes furrowed, partly from bad habits, such as the contracting of the eyes in myopia, and the

elevation or contraction of the forehead. These furrows in the face are also influenced undoubtedly by heredity; vertical folds in the forehead running to the root of the nose are often seen in young children, folds which ordinarily are caused only by reflection, anger, and evil thoughts. Finally, we may have a traumatic or toxic wrinkle formation in individuals who from the requirement of the occupation or from vanity use powders and cosmetics. Most cosmetics containing metallic astringents injure the skin if used continuously, especially when the skin is not properly cleaned between the times of application. Since these agents are used chiefly on the cheeks, deep repulsive furrows are often seen in these very conspicuous places.

What can be used against wrinkles? Nothing, of course, will prevent the increasing age. For the wrinkles nothing can be done except the using of cosmetics. Thick fluid or fatty cosmetics are the most satisfactory. The application of the former variety, in which the ground tone is first laid on and then the details added, has come to be an artistic work which is called enamelling. Faces so enamelled cannot be distorted either by laughter or by the expression of anger, since each muscular movement produces deep cracks in the paste; and the paste itself continually causes new wrinkles and deepens the old ones. The wrinkles may be less perfectly concealed by the inunction of fat and subsequent powdering, and still less effective are the moist warm and fatty poultices employed in the most ancient times and ridiculed by Ovid and Juvenal. These, indeed, loosen the skin, but after a short time the wrinkles appear more marked than before.

The folds which are caused by habit in younger persons may be more successfully treated. Here may be used any tonic or astringent agent in the form of a wash, which will be more efficacious when the habit causing the folds is given up. In such cases direct mechanical means are recommended. It may be possible in children to get a permanent improvement by the continued application of non-irritating plasters on the fold previously smoothed out. As a curiosity I give the following method: Two bits of plaster provided with silk threads are stuck one on either side the wrinkle. When the plaster is dry the threads are drawn tightly together and knotted (Débay). To remove the furrows in the cheeks it has been recommended to carry wooden balls between the cheeks and

[illegible] cosmetics.

[illegible] puberty

[illegible] dust. [illegible] many [illegible] cases in [illegible]

[illegible] these anomalies

constitute, they require treatment often for the diseases which follow them, such as eczema, comedones, and acne. This treatment must be of two sorts, according to the nature of the disease. The fat and the crusts must be removed. If the former alone be present, seborrhœa oleosa, the use of alcohol or ether is often sufficient, or for a quicker effect the use of alkalies, soaps, and borax, or combinations containing these, such as spiritus saponatus kalinis. In the latter form where the crusts are to be removed, frequent applications of vegetable, animal, and mineral oils are indicated. This does not loosen the crusts themselves, but the sebaceous matter holding them together. The débris is then to be removed with soaps or alkalies. After these are once removed, we have before us a simple seborrhœa oleosa, which must be treated. While in general it may be said that seborrhœa is curable, there are certain obstinate cases which are so resistant even to a long-continued treatment, that they recur as soon as the treatment is left off, so that such patients must be kept under treatment most of the time. Frequently in young females the change in sexual life may cause the disappearance of the seborrhœa, and it almost always passes off in age. It goes without saying that when some underlying condition, such as chlorosis, which might cause the disease, is present, this should also be treated. Often such treatment alone is sufficient to cure the seborrhœa.

It is impossible to cure the lack of sebaceous secretion; the natural fat may only be replaced by inunction. If the lack of fat be caused by chemical agents, these should be avoided, or when this is impossible, the necessary fat should be applied to the skin after or before working with the chemical agents. In this case the saponification of this fat protects the fat of the sebaceous matter.

That form of disturbed secretion which produces comedones is worthy of our attention. These comedones are from pin-point to pin-head sized, brown or black points in the skin, generally of the face, and especially of the forehead and nose. They sometimes appear on the chin and more rarely on the bust. They correspond to the orifices of the sebaceous glands, and represent the free end of a sebaceous plug which fills the entire gland and which is usually discolored with dust or dirt. The brown color is not caused entirely by dirt,

but it is also no doubt true that the sebaceous matter mixed with epithelial scales may become dark from the action of the light, perhaps through oxidation. When the walls of the gland are compressed, the plug is squeezed out of the orifice and has the appearance of a small white worm with a black head. The contents of the comedo consist often, besides the constituents of the sebaceous matter and some cells, of a number of fine hairs, and at times also of a peculiar mite, the acarus folliculorum. The orifice of a gland remains gaping for some time after it has been pressed out. The development of the comedo is generally produced by a clogging up of the duct and a consequent passive dilatation of the gland. In other cases where the hair follicles are accessories of the glands, the irritation which the growing hair causes to the wall of the duct may lead to a slight inflammation and an active dilatation of the gland. In this way may be produced the peculiar sheath of the comedo. Finally, it cannot be denied that a comedo may develop on account of diminished tone of the walls of the duct. The formation of comedones after the first two methods explains their occurrence in persons who have abundant sebaceous secretion and are much exposed to the air, and also explains their occurrence about the period of puberty.

Single comedones are found in every skin; they only form a cosmetic anomaly when in great numbers. The comedo often becomes loose and is then carried off in the ordinary washing; if it exists longer, it may cause a local inflammation of the skin and furuncles and acne pustules may come on.

The treatment of the comedones is first the mechanical removal of the plug, by pressing the walls of the duct with the fingers or finger nails, or by pressing a watch key or Hebra's similar instrument over it. This is the most important part of the therapy. This very tedious procedure must be gone through with day after day. The comedones may also be removed by rubbing with sand, soap, etc.

The hypersecretion of the glands must also be combated with the agents mentioned before, soap, alkalies, and alcohol. Although these substances irritate the skin, no powder should be used after their application, since this may cause a clogging of the ducts of the glands and produce new comedones. In seborrhœa in general, the powdering of the face is harmful.

The secretion of the sweat glands also shows anomalies. In a beautiful skin the secretion of sweat should be imperceptible, although a certain amount is indispensable. In individuals in whom in consequence of skin diseases or general diseases (diabetes), the secretion of sweat is diminished or abolished, anidiosis, the entire skin or single portions of it appear dry and parched.

There may be anomalies both of quantity and of quality. The increased quantity, hyperidrosis, may be general or local. The latter is chiefly the object of cosmetic treatment. It is habitual in the face, the hairy scalp, the axillæ, about the genitalia, beneath the breasts in females, in the rima ani and in the palms and soles. The large quantity of sweat secreted in these parts has the composition of normal sweat, but is more easily decomposed on account of its stagnation in certain places, and on account of its mixture with epithelium and fat. Its unpleasant odor is caused in part by this decomposition. It may be said that every individual has a sweat with a specific odor. This odor, which is different in different parts of the body, becomes unpleasant to others only after its decomposition. The cause of the hypersecretion is not fully explained, although in certain cases and in special localities a reflex nervous action may be assumed. The development of the peculiar local hyperidrosis which interests us is not clear. Of the localities named, the altered quality of the sweat is most noticeable in the axillæ and on the hands and feet. In the axilla and on the feet and in other locations, hyperidrosis may cause other diseases of the skin, such as eczema and the formation of rhagades. The sweating in the axilla is more frequent in females than in males, and is disagreeable both on account of its bad odor and on account of the discoloration of the clothing which it produces. The dress shields of rubber or other material protect the clothing, and by preventing evaporation lessen the odor. The shields of doe-skin recently introduced are the most serviceable.

The sweating of the palms of the hands, although it has no disagreeable odor, is unpleasant both for the patient and for others. Such hands feel moist, cold, and sticky, as if one had touched a frog. "Such a condition renders theh and of the most beautiful woman unpleasant to the touch, and may often have cooled the glow of love" (Kaposi). No matter how often

the hand is washed and dried, it always appears covered with little drops of sweat; if this condition be of long duration, the epidermis becomes tender, often white, and occasionally vesicles appear on it. Wiping and washing the hands is of no avail. The sweating of the hands is found at every age in either sex, more frequently in the young, however, especially about the period of puberty, and perhaps more often in the female than in the male. Certain general diseases, chiefly disturbances of nutrition, such as chlorosis, seem to dispose to this affection. In such cases it may disappear of itself or continue stationary in spite of every treatment.

Still more disagreeable than these is the habitual sweating of the feet; first, because the skin is loosened and softened on the soles and the ends of the toes, and tears so that every pressure and even walking may be painful, and, second, because the stagnation of the secretion causes a very disagreeable, penetrating odor. The decomposition of the sweat is not the only cause of the odor; this is also produced by the decay of the loosened epidermis and the masses of sebum between the toes. This exceedingly bad odor is communicated to the shoes and stockings through their impregnation with the sweat, and these articles of dress are the principal cause of the bromidrosis. The odor disappears, as a rule, when they are removed. Carefully-washed feet left bare have no bad odor; just as the clothing is ruined by the axillary sweat and the gloves by the sweating of the hands, so are the stockings by the sweat of the feet. This sweating may be found in either sex at any age, and may continue from childhood to old age; it disappears sometimes of itself, but less frequently than the hand-sweating. It may be produced by excessive use of the feet, and such a local unhabitual hyperidrosis pedum may have the same unpleasant consequences as an habitual sweating of the feet. Sweating of the hands and feet is associated in many persons; the latter, however, is more frequently present by itself.

Apart from the bad odor which arises from the decomposition of the sweat and the other skin secretions, as well as of the epithelial masses, in consequence of their stagnation or their impregnation of articles of dress, specific odors, if in fact they ever exist, are very rare. I remember hearing Prof. Jarisch say that he had observed a case of bromidrosis in

which the sweat of all parts of the body had an odor suggesting the stable.

Other qualitative changes in the sweat occur as regards color. Cases of chromidrosis are reported in which the sweat is said to have been yellow, blue, green, or black. It is not rare to find sweat blue or yellow to orange-red. The latter is found in the axillæ of red-haired individuals. Interesting, but unimportant from our point of view, is the presence of urea in the sweat. In hairy parts, when there is hypersecretion and stagnation of the sweat, especially the axillæ, the pubes, and the genito-crural fold, the hairs have often larger or smaller round, yellow, or brown granular accumulations. These masses cling tightly to the hair. The microscope shows them to be yellow, fatty masses mixed with epidermis cells.

The treatment of the local hyperidrosis consists, first, in the frequent washing of the part, either with water or with agents which increase the tone of the tissues in general, as alcohol, dilute acids, alum, etc. In many cases hydrargyri chloridum corrosivum, acidum salicylicum, and naphthol are of service. An important indication in the treatment of hyperidrosis is the isolation of sweating surfaces from each other. For this purpose agents are employed which absorb the sweat, as all sorts of powder, which may either be sprinkled on the surface or used on pledgets of cotton wool. Often in severe cases of habitual sweating of either the axillæ or the hands and feet, the unguentum diachyli Hebra is of great value. The most important indications are frequent washing and frequent changing of the clothes, which should be thoroughly aired. The manner in which this treatment is to be carried out will vary with the location. Where hairs are present, it is necessary to free these from the concretions by washing, best with alkaline soaps, and this is at the same time the best means of preventing the odor. After this the part should be moistened with one of the alcoholic fluids mentioned, which is allowed to dry. The highly-perfumed and recommended *vinaigres de toilette* are much employed in sweating of the axilla. They have a certain value if used in the right place, since they contain vinegar and alcohol, remembering always that the mixture of a pleasing and a bad odor is unbearable and that the latter is first to be removed. In

the treatment of sweating feet, the greatest attention is to be paid to cleanliness. The layers of epidermis found between the toes are to be removed constantly. The treatment is to be begun only after the cleansing. Many cases of hyperidrosis pedum which are not severe are cured by bathing every evening with spiritus vini gallici. Potassii permanganas, often recommended for its deodorizing effect, can only be used on parts where the color it produces is not objectionable. The application of this in the form of a powder mixed with indifferent powders, especially to exposed parts, is useless. If the more simple means, such as washing and the use of powders on the skin and scattered in the garments, be of no avail, we may have recourse to Hebra's ointment. This is applied in the following manner. After the feet are washed and dried, a piece of linen spread with the salve is wrapped about them, the spaces between the toes being filled with pledgets of cotton on which salve has been spread. If the patient is in a position to give up his occupation, rest in bed will hasten the cure. The salve is to be renewed in twenty-four hours, the feet not being washed but cleaned with cotton wool and powder. As a rule, the disease is cured in from one to three weeks, and the superficial epidermis is cast off, after which powder is to be frequently used. Acidum salicylicum and acidum tartaricum, which are often added to such foot powders, may cause erosions and rhagades in a sensitive skin. The vegetable powders are to be avoided, since these may cause harm by swelling and producing pressure on the skin. The unguentum diachyli may be used in obstinate cases of axillary sweating also.

All dermatologists now acknowledge that the treatment of these local hyperidroses has no injurious effect on the organism. The secretion of the sweat is lessened by a number of agents given internally, and local hyperidroses have been treated in this manner. In ancient times those medicines were used which increase the secretion of urine. The old Greeks and even modern physicians have recommended a decoction of artichoke roots; in later times agents which check directly the secretion of sweat, such as atropine and agaricin, have been employed. These drugs, which have a remarkable effect in general hyperidroses, sometimes are followed by permanent results in local hyperidroses, often only by transitory.

The uniformity and beauty of the skin is affected by a number of diseases which come within the sphere of cosmetic considerations; these are callosities, corns, warts, and chill-blains. The callosities (callositas, tylosis, tyloma) are lentil-shaped, yellow or brownish, horny thickenings of the skin, not sensitive, and closely connected to the underlying tissue. They are thickest in the centre, one-twentieth to one-fifth of an inch or more, thinner toward the margins, and are composed of horizontal parallel layers of horny cells. In most cases they come from an external cause; in rare cases they are idiopathic. The latter often disappear spontaneously. The external cause may be mechanical, as repeated pressure of one point in the skin against the underlying bone; or chemical, as the effect of lye, mineral acids, etc. Pressure callosities are found normally in the skin on the heels and the soles, but may become abnormally thick when the shoes are rough. Similar callosities arise beneath trusses and corsets, and are very frequent in the palm of the hand. They develop often, when the pressure is only occasional but severe, from a recurring vesicle. Such callosities are found, for example, on the palms of young girls who are being initiated into the mysteries of housekeeping. In manual laborers these are very extensive and in their location characteristic for each trade. Although these protect the skin from further harmful influences, they may cause annoyance by lessening the sensibility of the skin or by the production of deep, painful rhagades.

The treatment consists in the softening and removal of the callosities, or more simply in the removal of the cause. The softening is brought about by warm baths, by sweating poultices, by enveloping in impermeable stuffs, finally by all agents which cause swelling or dissolution of the horny substance, such as lyes, acids, etc. The most serviceable treatment consists in bathing the part with a dilute alkaline solution and covering it with gutta-percha cloth impregnated with acidum salicylicum, taking care that only the callous parts are covered.

The corn (clavus) differs from the callosity in that it is not flat on the skin, but that there exists a circumscribed horny thickening in the skin which resembles a nail. The corn consists, like the callosity, of horny cells superimposed in parallel layers, which here and there appear red or brown from the

blood coloring matter which has escaped. Corns are also usually produced by continued pressure of the skin against the bone and rarely arise spontaneously. The skin of some individuals, however, seems especially disposed to such growths. Corns are found on almost every foot, especially on the toes, over the joints, as well as on many points of the sole where the shoe can press the skin against the bone. Exceptionally corns may be found on the middle finger of the right hand in persons who press the pen too tightly in writing. It is erroneous to suppose that corns are only produced by tight shoes; wide and improperly made shoes may have the same effect. The cutis beneath may be atrophied or the papillæ may hypertrophy. The parts about the corn show often an inflammatory infiltration. Pressure from the shoe or other objects may cause intense pain in the underlying skin. Many individuals with corns are affected by the influence of the weather; those between the toes, which are covered with loosened epidermis, are the most painful. While with callosities the simplest treatment is the removal of the cause, this is not so easy with corns, for the wearing of better shoes only prevents, as a rule, the development of new corns; those already existing must be removed. Chiropodists make use of a great number of instruments which in a skilled hand reduce themselves to a razor with a small blade and a myrtle-leaf knife. The plasters and bandages used by these individuals are often of no value, and may by their pressure cause other callosities or corns. Corns are to be removed either by the use of agents which swell or dissolve the horny substance, as lyes, acidum aceticum, gutta-percha mull with acidun salicylicum, or by shaving them off in layers and then digging them out entirely with a knife after a warm foot-bath. In this latter operation, bleeding vessels of the hypertrophic papillæ must be touched with argentum nitricum. With the knife, wounds may often be caused, which should be treated antiseptically, and which not infrequently give rise to tetanus and other dangerous diseases. The physician should not be above performing these small operations himself, and should not turn the patients over to inexperienced persons for operation. The filing off of corns with a steel file has only a palliative effect. Rings of caoutchouc, leather, or wool are merely prophylactic.

Warts, verrucæ, are round, elevated, smooth or irregular, colorless or pigmented growths upon the skin. They may be congenital, but are mostly acquired. The former are always dark-colored and provided with hypertrophic hairs. The acquired are divided, according to their from, into flat (verruca plana), hemispherical (verruca glabra), and glandular (acrothymion) warts. They consist of hypertrophied papillæ with lengthened and dilated vessels, above which there is a thick mucous layer. They develop under the epithelium; later this is pushed forward and becomes constantly thicker. Warts grow slowly or quickly, on the hands, feet, face, and on the hairy scalp of young persons, and may either last a lifetime or disappear spontaneously. The cause of their development is often obscure. They are not contagious. Their spontaneous disappearance accounts for the fact that often after one is removed by drugs or operative measures, the others disappear of themselves.

Among the agents for the cure of warts are some ancient specifics which are still used by the laity, such as the juice of celandine, of the fig, of ivy, of water-hemlock, etc. Even the dung of goats and of doves stirred in vinegar has been employed. The simplest and best means is the cauterization with caustic potassa, concentrated mineral acids such as acidum nitricum, a paste with acidum sulphuricum, acidum chromicum, or concentrated acidum aceticum; further, the application of ferri chloridum or hydrargyri chloridum corrosivum, and finally, covering the wart with mercurial plaster to which arsenious acid has been added. Cauterization with the stick of argenti nitras is as a rule of no service. Because of the unpleasant influences of these agents on the surrounding skin, and because the amount of cauterization cannot be accurately gauged, warts are also removed by tying a strong thread about them, by snipping them off with the curved scissors, or by scraping them out with a sharp spoon; tearing them out with the forceps is a barbarous operation. After the operative removal of a wart, the surface of the wound should be cauterized, both on account of the bleeding and to prevent its return. The cicatrices which ensue must be taken into consideration, and since warts often disappear spontaneously, it is often well not to operate when they are located on the face. The cicatrices after electrolysis are less noticeable,

and this operation is less painful. It is made by transfixing the base of the wart, parallel to the surface of the skin, with a needle-shaped negative electrode, while the positive electrode is held on any portion of the body. The strength of the current must be measured by a galvanometer, and should not exceed five milliampères. The effect is a chemical one, the alkalies formed, acting as caustics. This employment of electricity has nothing to do with the galvano-cautery.

Perniones, or chilblains, are circumscribed reddenings of the skin with or without swelling, which develop in various parts of the body in consequence of exposure to low temperatures. They are most frequently found on the hands and feet, the face, the nose, and the ears. They are round, red spots, livid in the centre, from the size of a dime to a half-dollar, hard or soft, flat or elevated. They may exist but a short time or be of long duration, and in the latter case they become more livid and the skin tissue is filled with dilated vessels, and may be covered with thin, shining scales or may later excoriate and ulcerate. Chilblains cause, mostly in the evening and in a warm room, a severe pricking pain and intense itching, and at times, when on the hands and face, are actually disfiguring. While chilblains occur at times in every person, there are individuals, mostly anæmic and poorly nourished, who seem disposed to them, and in such individuals they may develop with a temperature no lower than 40°. The clothing has a certain influence on the development of chilblains, since they are found often after closely-fitting gloves or shoes, which check circulation, have been worn. For some unknown reason this disposition diminishes as the person grows older.

The treatment of chilblains is both prophylactic and curative. The former consists in having persons in whom the disposition exists, wear warm foot and hand coverings, avoiding those lined with fur. Sudden changes of temperature should be avoided. On this depends the good effect of wearing woollen stockings through the winter and even at night. Warm hand and foot baths, which render the skin more sensitive to changes of temperature, should also be avoided. On the contrary, cold baths and rubbing are to be recommended.

Of the numerous agents used in the treatment of existing chilblains, the astringents and tonics deserve attention. To these belong dilute mineral and other acids, such as acidum

nitricum and acidum citricum, acidum tannicum and its preparations, sodii boras, alumen, salts of lead, and iodine. The other agents recommended, such as balsams, baths of hot glue, hops, etc., only indicate how unreliable are the agents usually employed. Ulcerated or excoriated chilblains are to be treated on general surgical principles. In many cases it will be required to conceal the disagreeable livid, red color, and for this purpose, apart from the acids, it may be necessary to use cosmetic salves and powders.

It will be seen from what has been said that cosmetic treatment varies in different parts of the body.

The cosmetic remedies in general may be divided into two groups. The first comprises the agents serving hygiene and cleanliness and a number of the curative agents, and corresponds to the agents belonging to the ars ornatrix of the ancients; the second group comprises those agents which conceal that which the first group has been unable to cure. These are the substances which belonged to the ars fucatrix.

Many of the agents of the latter group have a curative action as well, and these are intermediate between the simple hygienic agents and the special cosmetics.

The cleansing and hygienic agents are, first, water, soaps, and fats, then alcohol, alkalies and acids; the latter three have special actions.

Water.

Of the agents externally applied, water takes the first place in general medicine as well as in cosmetics. The priest-physicians of the Jews, the Persians, and the Chaldees prescribed simple water-baths for both therapeutic and cosmetic purposes. Baths in the sacred Ganges, in the deified Nile, brought to men and women not only health, but youth and beauty: and although in the course of centuries water and baths were often neglected for long periods, they never lost their importance as the simplest agent for preserving health and beauty. The knowledge of this importance has grown so with the increase of medical and hygienic knowledge that the grade of civilization may be gauged not only according to the use of soap, but according to the use of water.

Water acts on the skin as a chemical and mechanical agent,

[illegible] barrier of heat and cold; by its property of dissolving [illegible] substances, it makes them active.

[illegible] the surface of the body in two ways, by dissolving [illegible] portion of the fatty acids, and many albuminates [illegible] again by causing the swelling of some of the [illegible]

[illegible] applications, as in dipping the body in cold water [illegible] baths, the first variety of its action comes but little, the second not at all, since the normal epidermis [illegible] permeated by the water and no swelling can be [illegible] the contact with the water be of longer duration, [illegible] water be moved, as in washing and scrubbing, or if [illegible] higher temperature, there ensues, first, the solution of [illegible] substances collected on the skin, then the mechanical removal of the superficial epithelial layers which hinder the [illegible] of the water to the deeper layers by the fat which [illegible] contain, and finally the swelling of the deeper layers.

[illegible] swelling of the tissue, which is at once perceptible, [illegible] the use of water or of steam for another reason.

In a bath of a temperature near that of the skin, the perspiration ceases, no sweat is secreted, but the fluid usually [illegible] is retained in the skin,[19] and causes a succulence of the latter. A swelling by imbibition and a swelling by decreased excretion may be assumed. The chemical changes in the skin are influenced by the increased swelling, whether it be caused in one way or the other, and by the effect of water of higher or lower temperature on the vessels, causing their dilatation or contraction. The excretion of sweat may be increased or diminished, it being also dependent on the individual differences in the amount of water contained in the skin.

The nutrition of the individual is improved by the methodic employment of water, and this leads to the better nutrition and the beautification of the skin. The contraction or dilatation of the vessels, and in consequence the color of the skin, is changed by long-continued bathing.

The methodic use of cold water has a considerable influence in accustoming one to low temperatures; the skin becomes "hardened," and it as well as the remainder of the body becomes less sensitive to cold.

The forms of disease which are benefited by hydrotherapy are general paleness and bad color of the skin, whether this

be produced by poor nutrition, by anæmia, or by local causes; in such cases warm-water treatment, the employment of warm sitz-baths, rubbing, and packing are beneficial. A too intense color of the skin from overfilling of the vessels indicates, when general, the use of cold, running water; when the overfilling of the vessels is limited to single regions, derivative applications may be made to distant parts of the body; when there exists redness of the face, hot foot-baths are useful. Those transitory hyperæmias of the skin which are frequently produced by the continued influence of too hot or too cold air (erythema fugax) are often cured by cold baths and the local application of cold water. Water is also of service in the hypersecretion of sweat. Rubbing with cold water and a treatment especially adapted to the individual case often effect a speedy cure.

There are few contra-indications to the use of water as a medium for washing. There are persons whose skin will not tolerate hard water or soap and water. This is especially the case with the tender skin of the face. The continued use of cold water as a bath or douche for the hairy scalp leads to the early falling out of the hair. The methodical application of warm and of cold water may be injurious for several reasons. Warm baths taken too frequently relax the skin, dilate the vessels, and lessen the resistance to atmospheric influences. The bad effect of excessive use of cold baths is shown in this description which Winternitz gives of a water fanatic: "The skin is as dry as leather, unelastic, having no fat, being poor in blood, and gives the impression of being a lifeless tissue." The average interval between the baths should be eight to fourteen days; apart from special cases and from cold baths in the hot season, lukewarm baths, followed perhaps by the cold douche, should be taken as a rule, and even the cold baths in the summer should be varied at times by a lukewarm bath.

Seldom is water used which has the chemical constitution H_2O; the water of springs or streams contains various salts. Waters which are not suitable for drinking purposes are also often unsuitable for the bath. Waters which contain great quantities of ammonium, acidum nitricum, and nitrates, or organic substances, should be avoided when possible. This is still more the case with waters which contain macroscopically visible dirt, whether it be of organic or of inorganic nature.

Water also which is excellent for drinking purposes may in its natural state be harmful when used for bathing. This is true of hard waters, well waters, and even our excellent high spring water. The salts of calcium and magnesium, on which the great hardness depends, make the fine skin of the hands and face raw and coarse.

The use of rain and river water is to be recommended for washing the face and hands. Where this is not easily obtained, hard water may be freed from its harmful calcium compounds by long boiling or by the addition of soap, soda, or potash.

Often water is not used pure, but has different ingredients mixed with it. These may be substances which serve to make the bath more pleasant, as many aromas; or those which have cosmetic value, as soap, soda, and potash; or those which have a certain value of this sort and serve as well to maintain a certain temperature of the bath, as size or glue.

Water is used in two manners, either to wash with or to bathe in. In the former, fresh water is repeatedly brought to the part by the hand or other means, and a certain amount of force being used, the skin is rubbed. The material to be used must vary according to the sensibiltiy of the skin. This may be flannel, coarse or fine Turkish linen in the form of little sacks, bath gloves, or bath sponges. The latter, on account of their great porosity by which quantities of water are absorbed, are excellent for washing. There are several sorts in the shops, two of which may be used for the toilet. For the face, and especially for a delicate skin, those from the Spongia mollissima and the Spongia zimocca, fine-pored and very soft, are to be recommended; for the skin of the body the large-pored, rough horse sponges from the Spongia equina and adriatica are better. By washing a greasy skin or after absorbing soapy water the sponges get a greasy appearance, get doughy, soft on the surface, and are then unfitted for bathing purposes. If they are boiled in a soda solution and then washed with clean water, they are again made fit for use. Lately, in place of sponges, luffa has been introduced into the market. This is the fruit of the Luffa ægyptiaca (Cucurbitaceæ) cut open, cleaned, and dried, and is similar to the sponge. The peculiarly-webbed, woody fibres of the inner side are dry, hard, and rough, but absorb either cold or warm water ready.

They are not injured by long years of use. The Egyptian women owe their fine complexions to the use of these.

The bath may be local or general, or a douche or a shower-bath. According to temperature, baths are cold from 60° to 70°, cool from 70° to 80°, lukewarm from 80° to 95°, warm from 95° to 100°, hot from 100° to 112°. Roman and Turkish baths are combinations of vapor baths with cool and warm full baths and similar douches.

The duration of the bath should be, for cold and hot, five to ten minutes; for the others, thirty minutes or more.

As to the time and manner of washing, the following may be said. It is best in the evening, before going to bed, to cleanse the body thoroughly from head to foot. In the morning, if the skin be sensitive, only the hands and face should be washed. If there be considerable perspiration, the entire body should be washed, but superficially. The wiping is best done with rough Turkish linen or with hairy, woollen cloths. The skin of sensitive individuals should then be powdered; the skin should at any rate be completely dried in a warm room. The moist skin exposed to the cool morning or evening air soon cracks and becomes rough.

In general, warm baths should be indulged in once a week. The skin is to be cooled before leaving the bath, with a sponge dipped in cold water or by a cool douche. Cold baths and river-bathing, which is common in summer, are permissible, but they should be varied by warm baths. The skin of many individuals will not bear the continued cold baths, and this is especially the case when the water is hard.

Although water is one of the most important cosmetic and cleansing agents, it does not answer all the cosmetic requirements and some more active agent is needed. First in this regard is soap. On account of its importance we shall consider it in detail.

Soaps.

Soaps are combinations of fatty acids with alkalies. Their chemical and physiological properties depend on the latter. On the skin, they act in a manner similar to the alkaline carbonates; like these they soften, swell, and dissolve the epidermis, and cause irritation, redness, and swelling of the under-

lying layers. The best soaps contain free alkaline carbonates, which cause saponification of the sebaceous matter collected on the skin. As long as this saponification and solution of the fats is confined to the surface, it is a desirable action of the alkali and increases the value of the soap. The fat of the skin is not only excreted from the sebaceous glands upon the epidermis, but there is also fat which is formed within the tissues. If sharp alkaline soaps or alkalies be applied to the skin and the tissue become swollen and destroyed, the fat that is in this is extracted; not only cleansing is produced, but also saponification and more or less deep cauterization.

Formerly the whole action of the soap was attributed to the alkali contained in it. The action of the alkali, however, especially in the cosmetic application of it, is not the only one. It is the sum of a number of separate actions, which makes soap the most important of cosmetic agents.

Besides the physiological action, there is also a chemical and a mechanical action. The chemical action depends on the easy decomposition of the soap by water. The soaps, which are neutral alkali salts of the fatty acids, are decomposed by water in such manner that an acid oleic alkali is precipitated, while a basic oleic alkali remains dissolved. The latter performs the chemical portion of the work; it combines with the acid constituents of the skin secretion, with the dirt, and with the fatty acids of the sweat to form a new acid oleic alkali. The insoluble part of the soap, which becomes an acid oleic alkali, has the mechanical task of surrounding the new-formed combinations and keeping them suspended; in this it is aided by the property of the soap of forming with water a permanent foam which takes up not only the new-formed combinations, but also those elements loosened by the friction, such as epidermis-scales, hairs, dust, and dirt, and prevents their adherence to the skin.

The marked physiological action of the soap, the action of its alkalies, is not always desirable; especially in its daily use this action is subordinate to the two others. It is avoided only when completely neutral soaps are used; and by the use of such soaps the other requirements are also better fulfilled.

The chemical work is always performed by the soap; the result, however, is only complete when the mechanical part of the work is well carried out; since this latter depends in

great part on the mode of manufacture of the soap, we must consider this.

Soaps are made by combining different fats with alkalies. These latter do not unite directly with the fats, but a saponification of the latter occurs which produces the glyceride of the fatty acids. This is split up into glycerin and the fatty acids, whereupon the latter unite with the alkalies to form soap. Therefore those fats which contain free fatty acids, such as palm oil and cocoanut oil, are more readily saponified than completely neutral fats, such as tallow and grease. The breaking up of the fat does not occur suddenly, but gradually, after the fat has formed an emulsion with the alkaline lye. The process may be hastened by previously making an emulsion of the fat, either with soaps or with albumen.

We distinguish soaps according as they are soft (fat with potash lye) or hard (fat with soda lye); further, as to the fat used, tallow, oil, palm-oil, cocoanut-oil, train-oil, oleic-acid soaps.

There are the following varieties of hard soaps: (1) Ball soap, produced by the boiling of fat with potash or soda lye; the soap is precipitated with salt, by means of which, when potash lye is used, potassii chloridum is formed; the crumbling masses are boiled into a ball—*i.e.*, a uniform crystallized mass without bubbles. Small amounts of impurities cause a natural mottling. This soap, now not often manufactured, is the purest soap, since the salting frees it from excess of lye, from impurities, and from a great part of its water. If this sort of soap be mixed with water or weak lye, water is absorbed and the soap does not crystallize. This is (2) the ground or smooth soap, which is manufactured like the other, and only differs from it in containing more water. If the soap solution be salted slightly or not at all, the soap remains mixed with the superfluous lye, the water, and the glycerin. This mixture hardens as soon as it is cool if concentrated lye has been used; and after steaming if weak lye has been used. This is (3) the filled soap, which contains an excess of lye, water, and glycerin. If it be kept, the water evaporates, it decreases in weight and volume, and the alkaline salts crystallize on the surface.

The raw materials used are first various fats, some of which have a cosmetic value and will be spoken of later, such as grease, tallow, olive and castor oils.

Others are of interest to us only on account of their use in the manufacture of soap, and will be mentioned briefly.

Palm oil, extracted from the fruit of the Elais guineensis, is a fat of buttery consistence, dark or orange-yellow in color, and of an agreeable smell, recalling iris root. It contains many free acids and a yellowish-red coloring matter, which is not disturbed by the process of saponification, and the palm soap made from this oil has, therefore, a yellow color. This coloring material can be destroyed by potassii bichromas or acidum sulphuricum, and oil so bleached makes a white soap.

Cocoa oil and cocoa butter, the fat of the fruit of the Cocos nucifera, is of buttery consistence, white, and has an unpleasant odor, which is not lost in the manufacture. It is one of the chief fatty substances used in making soap, since it is especially adapted for the manufacture of the filled varieties.

Other fats less frequently used are red galam or shea butter, from the Bassia Parkii and the bassia oil, both yellow, similar to palm oil; and further, vateria tallow, from the fruit of the Vateria indica, carapa oil, and mafurra tallow.

In the manufacture of stearin candles, quantities of raw oils, consisting of stearic and palmitic acids dissolved in oleic acid, go into the refuse, and these are used in the manufacture of soap.

Besides the animal oils given above, the train oil from the whale, dolphin, and walrus is used in the manufacture of soap.

Liebreich has recommended the saponification of the oily fruits, pure or mixed with other oils. As an addition to ordinary soaps, colophony and silicic acid in the form of water-glass are used.

The second raw material is the lye, which was formerly prepared from wood ashes or potash, but is not found ready prepared on the market.

The manufacture of soap is effected by adding lye to fats, and heating until saponification occurs. To this fluid is then added salt, and after repeated boiling the lower part of the fluid is allowed to escape. The salting takes place, as was said before, in the manufacture of the filled soaps and the potassium soaps. The salting and boiling has the effect of separating the excess of alkali. That this latter is very injurious in toilet soaps is seen from a statement of Liebreich[20] which deserves notice. According to this author, the fluid soap is first sepa-

rated from the cellulose of the fruits by a centrifugal machine, and then the precipitated ball is separated from the under lye by heating and going a second time through the centrifugal process. In this manner it is possible to obtain soap entirely free from alkalies. If soda lye be used for the saponification, since the salting is done with sodii chloridum, only soda combinations are formed with the oleic acid, and the soda ball soap so obtained is very hard; if potash lye or a mixture of potash and soda lye be used for the saponification, soda and potash combinations are made with the oleic acid; these are soft and mild and impart their characteristics to the soap. The manufacture of cocoanut-oil and potash soaps requires another process; the former is produced, not by boiling, but by treating the melted fat with strong soda lye. The potash soaps cannot be salted with sodii chloridum, since in this way chemical displacements occur and a hard soda soap would be produced. Salting with potassii chloridum may then be employed in order to separate the soap from the lye and other impurities.

The soaps produced in this manner are: 1. Tallow ball soap, made by the saponification of beef tallow with potash lye and salting with sodii chloridum. It is thus a mixture of potash lye and soda soap, white, neutral, odorless, and mild.

2. Soda ball soap or soda soap, of tallow and soda lye, salted with sodii chloridum, very hard, white, neutral, odorless.

3. Oil soap, Marseilles, Venetian, Castile soap, composed of olive oil and soda lye salted with sodii chloridum. This soap is mottled by the addition of ferri sulphas, which becomes darkly colored by the sodii sulphas of the soda lye (mottled Castile soap). If pure lye and pure oil be used, a completely white soap is produced, hard, neutral, and odorless. The alcoholic solutions of the oil soaps prepared hot, differ from the tallow soaps in that they do not become gelatinous on cooling.

4. Cocoanut-oil soap, made of cocoanut oil and strong soda lye or sodii carbonas without salting; filled, having often as much as seventy-five per cent of water, an excess of soda lye and sodium; white, transparent, alkaline, light, lathering well, of unpleasant odor, which cannot be removed. Cocoanut oil is often mixed with other fats, such as palm oil, or artificially mottled by the addition of iron red, brown red, or Frankfort black.

5. Palm-oil soap, of palm oil alone or with beef tallow, with colophony and soda lye; yellow, of agreeable odor.

6. Soft soaps, potash soaps, green, black, train soaps. Olive oil and hemp, rape, linseed, or train oils with potash lye and potassii carbonas; generally filled, honey yellow, green or black (colored by logwood and ferri sulphas); of unpleasant odor, strongly alkaline.

Other soaps, intended for the poor, are the yellow resinous tallow soap, either a soap prepared from colophony and tallow with soda lye, or a German palm-oil soap mixed with resin soap; the oleic-acid soaps, bone soaps, a mixture of resin or cocoanut-oil soap with bone jelly or with the whole bony mass, Liverpool poor soap; silicic soap, an ordinary oil or tallow soap to which silicic acid is added. Instead of mixing in the silicates, these are introduced into the soap in a water-glass solution. Such soaps readily make the skin raw; a white powder is precipitated which is only removed by repeated washing. The manufacture of such soaps still increases, although complaints are made on all sides of the adulteration. Not only the lye, the water, and the glycerin are retained, but resin and water-glass, as well as starch and sugar (10 to 40%), are added, so that from 100 parts of fat, 500 parts of soap are made, or in 2,400 pounds of soap there are 800 pounds of adulterating matter.

Of the soaps named, one may use for washing the body either the German tallow ball soap, the oil soap, or the palm-oil soap; the soda soap is too hard; the cocoanut-oil soaps and the soft soaps are too strongly alkaline, affect the skin, and have an unpleasant odor. The former fill the wants of the public, but often not the requirements of the hygiene of the skin; many a tender face suffers from the use of tallow ball soap.

A good toilet soap must fulfil the following requirements:[21]

1. It must be neutral in reaction; bad soaps, the filled soaps, contain free alkali and are corrosive.

2. The percentage of water in the soap must be neither too great nor too small. The former deceives the purchaser. The latter makes the soap too hard, it does not foam readily, and is consequently less valuable as a toilet soap. A soap having the proper quantities of the ingredients will foam as soon as water is added to it.

3. The lathering of the soap is hindered by the presence of free fat. The soap also gets a rancid odor when kept long. The over-fatty soaps may be of cosmetic value on account of the softness of their lather. Such soaps may be prevented from becoming rancid and sticky by using lanolin in place of the ordinary grease.

4. The soap must be odorless or have a pleasing odor and a constant agreeable color.

5. The soap must cleanse the skin and render it flexible. Substances added for this purpose, as well as the coloring and perfuming matters, may be poisonous.

The manufacturers of toilet soaps seek, or at least should seek, to fulfil these requirements.

In England the soap manufacturer seldom makes his own soaps, but procures these from the real manufacturers and subjects them to various procedures. The toilet soaps made there are generally good. In France and Germany the perfumer makes his own soap, generally by the cold method. The English dealers make their toilet soaps by remelting raw soaps and by the cold perfuming of odorless soaps. The former method consists in melting the soap, then adding the perfume and stirring it well; in the second method the cold soap is broken up, perfumes and coloring matter added, and the whole macerated between cylinders into a uniformly colored and perfumed mass. The whole procedure is done by a machine, and such soaps are called pounded soaps. Soaps so treated become gray, and the method cannot be employed for the production of white soaps. In the direct preparation, the perfume and the pigment are mixed with the soap while it is still soft. This is, however, impossible for the most highly-perfumed soaps. Fine perfumes decompose or evaporate at the high temperatures required for the saponification.

In Germany, therefore, the cold saponification is preferred for this purpose. In this manner a filled soap is produced which is not less valuable on account of the excess of glycerin and the salts produced by the use of the pure lye, but is often harmful on account of the excess of caustic lye. This fault may also cause the gradual decomposition of the perfumes added to it. At any rate it is very difficult, and only possible after long experience, to produce by the cold method an almost neutral soap, not having an excess of fat, lathering well, and not becoming rancid.

The various ethereal oils are used for the perfuming.

For the coloring, red is produced by cinnabar, corallin, and fuchsin (free from arsenic), at times ferri oxidum and also carmin, which can be used only in neutral soaps. Yellow is produced by cadmii sulphas, uranii oxidum, saffron, orleans, and palm-oil soap, which is yellow. Violet is produced by coal-tar colors. Blue is produced by smalt, ultramarine, and indigo. Green is produced by mixing yellow and blue. Brown is produced by a solution of granulated sugar in lye or by caramel or cocoa meal.

In order to make it transparent, dried soap is dissolved in alcohol, cooled, perfumed, and colored with cochineal, aniline, or acidum picricum and martius yellow. Soap is now often dissolved in its weight of glycerin and then treated like the soap dissolved in alcohol.

Transparent soaps only become hard after several weeks. There are great adulterations practised now in the manufacture of transparent soaps; many of the English soaps contain syrup, free alkali, or resin and sugar, without a trace of glycerin.

Since soaps are mostly bought and seldom specially made, only a few recipes for well-known soaps will be given.

The popular brown Windsor soap, which is cheap and serviceable, is made as a ball soap by the saponification of two parts of mutton tallow and one part of olive oil, with soda lye; it should be neutral. It is perfumed with a mixture of caraway, bergamot, lavender, Spanish hop, and thyme oils, and colored with caramel or cocoa from which the fat has been removed.

Another recipe gives three parts of white ball tallow soap, one part each of cocoanut-oil soda soap, yellow palm-oil soap, and grease soap. These are to be melted together, then perfumed and colored. To make white Windsor soap, the yellow soap and the coloring matter are left out.

Rose soap is made by melting together three parts of oil soap and two parts of tallow soap. This is perfumed with rose and geranium oils and colored with cinnabar. It may also be made by perfuming cold rose-red ball tallow soap with rose oil, sandal wood, and geranium oils.

Almond soap is made by melting white ball tallow soap with oil and cocoanut-oil soap, perfuming with the oils of bit-

ter almonds, cloves, roses, and caraway. In place of the bitter-almond oil nitrobenzol is often used.

In this manner most of the toilet soaps are made. The name comes usually from the perfume used, as, for example, savon à la Violette de Parme, à l'Ixora, etc. That the name is often fanciful and has nothing to do with the ingredients of the soap is shown by the spermaceti soap, which is a simple white tallow soap strongly perfumed with bergamot and lemon oils.

The light or lather soap is made by melting palm or olive oil soap with from one-eighth to one-third its volume of water, and stirring until the foaming mass has reached double its volume; it is then perfumed with various ethereal oils. Tallow soaps cannot be made into lather soaps.

Softer soaps are generally sold as shaving soaps. Such a soap made from pork fat and potash lye with concentrated alcohol and perfumed with the oil of bitter almonds is the crême de savon à l'amande, a soap shining like mother-of-pearl. This scented with oleum menthæ piperitæ and colored with aniline violet is the crême d'ambrosie, fragrant soap for shaving. Soap made from oil and potash lye is transparent.

Soaps are used also in fluid form, and there are two of these worth mentioning. The one, the fluid glycerin soap, is a solution of soap in an excess of glycerin (30:35); Sarg's glycerin soap is an olein potash soap made of very pure materials with two-thirds glycerin, which is filtered and then perfumed with rose oil. It is clear, light brown, having the consistence of honey and containing free alkali. It does not lather much.

The second is the potash soap spirit, spiritus saponis kalini, according to the Austrian Pharmacopœia, a filtered solution of two parts of sapo viridis in one part of spirits of lavender; in this form it has a not unpleasant odor.

Other fluid forms are the soap essences, concentrated alcoholic perfumed solutions of soap.

Kali-crême, which is the sapo kalinus albus of the German Pharmacopœia perfumed, and the spiritus saponis kalini, are cosmetic agents in a wider sense than the hard soda soaps, since free alkali or alkaline carbonates, which modify the soap, have their share in producing its action. These are, therefore, properly to be classed with the alkalies. Some believed that the injuriousness of the strong alkaline soaps might be pre-

vented by adding an excess of fat. This, however, as Liebreich has shown, is only partly possible. Unna composed a soda soap with an excess of fat, sapo superadiposus, and a similar potash soap, sapo unguinosus. The former is made by the saponification of 59.3 parts of beef tallow and 7.4 parts of olive oil with 22.2 parts of soda lye and 11.1 parts potash lye (28° Beaumé's hydrometer). With this composition four parts of fat remain unsaponified. Neither glycerin nor free alkali should remain. While it is possible in this soda soap to take up the free alkali with the excessive fat, this is impossible in the potash soaps. The latter, the sapo unguinosus,[22] is made according to Liebreich by stirring together fifty parts of oil of cocoa and fifty parts of fat (adeps suillus) with potash lye composed of twenty parts of caustic potassa and forty parts of water. This is left to itself for several hours while saponification is taking place. Within this time seventeen per cent of previously melted fat is added, and finally glycerin also. This soap then contains free alkali like every potash soap, and has an excess of fat.

These soaps having an excess of fat were supposed to allow the free alkali little action, and it was further supposed that they would oil the skin again, which is rendered dry and rough by the use of soap as well as of alkali. They were also thought to dissolve more completely the medicaments added. They do not possess the first property, since the alkali can only be neutralized by boiling the soap, and can only be removed by the centrifugal machine after the salting; but, as said before, the potash soaps cannot be salted. The free alkali is not neutralized in the soaps, but its action somewhat held in check by the presence of the fat. The percentage of free alkali is reduced, however. The action of potash soap is but incompletely obtained in using the preparations described.

The advantage claimed that the skin is at once oiled again after washing is harder to object to from a cosmetic standpoint. This oiling when the skin is sensitive, and in individuals who from their occupation must wash frequently, is very necessary, and Valenta, before the introduction of the sapo unguinosus, advised rubbing the hands, before washing with soap, with crême céleste. The advantage, however, is imaginary, for in washing off the soap the oily coating is also washed off. The objection to their use for cosmetic purposes

is that the fat easily becomes rancid and the soaps do not keep. The free fatty acids are unbearable to the skin; and for this reason the newly-introduced sapo superacidosus, having an excess of fatty acids, is to be condemned. Besides this, the fresh soaps with an excess of fat have an unpleasant odor and are not attractive in appearance. Rancidity may be prevented by adding lanolin to the prepared soap.

The long-known glycerin soaps and the potash soap spirit combined with glycerin are to be judged in the same manner. Glycerin in the quantities in which it is added to the soaps (twenty-five to forty per cent) has only the effect which the excess of fat in the sapo unguinosus has; it makes the action of the free alkalies milder, since it takes these up and lessens the percentage of the free alkali present. This is especially the case with the potash soap spirit; the preparation given in the Austrian Pharmacopœia lacks almost all the characteristics of a toilet soap; it does not lather well, it attacks the skin, makes it dry, rough, and fissured, and it has a bad odor. By using the better white potash soap, a better perfume, and adding glycerin, a preparation is made which, disregarding its action, is far pleasanter to use than the other. A moderate quantity of glycerin gives a certain consistence to the spiritus saponis kalinis, which favors its application. The percentage of glycerin may not exceed a certain limit—it may not be greater than the percentage of alcohol; if greater percentages of glycerin be used, the soap dissolves the epidermis less, makes a poorer emulsion, and is, therefore, less adapted to remove the dirt and fat of the skin. The peculiar action of the glycerin is mostly lost when it is combined with a soap. This soap, like the others, cannot be considered a universal cosmetic agent.

Besides the free alkalies and the glycerin, which as such have no action in the soap and merely modify or increase the action of the other constituents, there are other cosmetic and curative agents which may be incorporated into a soap.

For this purpose, fine quartz sand or finely-powdered pumice-stone are used in equal or double the quantity of the soap (ball tallow soap and cocoanut-oil soda soap mixed). Either this mixture, which is similar to and little better than the water-glass above mentioned, or dusting powder is added, which in a different manner from the soap make the skin

flexible, soft, and of a lighter color. Such a soap is the hygienic toilet soap devised by Auspitz, which is made from tallow and cocoanut oil with potash and soda lye, to which is added glycerin, flores zinci, pulv. alumin. plumos., and amyl. oryzæ, and it is then perfumed with oil of lemon and rose oil. In place of this the cosmetic soap given below, prepared from white soap by the apothecary, may be used. I am convinced of its value. Paraffin is also added to soap for this purpose. Ordinarily such toilet soaps are prepared and prescribed in a special form. Among these are the beauty-balls, soap-emulsions, and soap-powders. The latter are made by cutting soap into chips, drying it, and pulverizing in a mortar. Some examples follow:

℞ Talc. venet. præp.,
Amyl. oryz.,
Sapon. odorat., ... ää q. s.
M. f. globuli. S. Savonettes à la Bergamotte.

℞ Furfur. amygdal.,
Amyli,
Sapon. in pulv., ... ää ʒ ij.
Pulv. rhiz. irid., ... ʒ i.
Tinct. benzoini, ... q. s.
M. f. pasta in globul. form. S. Beauty-balls.

℞ Sapon. pulv., ... ℥ i.
Sodii carbon. sic., ... ℈ ij.
Amyl. oryz., ... ʒ iij.
Pulv. irid., ... ʒ iss.
Mixt. odorif., ... ʒ i.
M. S. Poudre de Fèves.

℞ Sapon. pulv., ... ʒ vi.
Borac. venet.,
Zinc. oxid., ... ää gr. xvi.
Essent. millefl., ... q. s.
M. S. Soap-powder. Recommended for the hands of physicians.

℞ Sapon. alb. in pulv., ... ℥ i.
Acaciæ pulv., ... ʒ ss.
Rhiz. irid. pulv., ... gr. xv.
Ol. rosæ,
Ol. bergamii, ... ää q. s.
M. S. Soap-powder for shaving (Trommsdorff).

℞ Sapon. kalin., ... ℥ vi.
Spir. vini rect, ... ℥ iij.
Solve et filtra. Dein adde:
Glycerini, ... ℥ iij.
Ol. geranii,
Ol. bergamii, ... ää q. s.
M. S. Modified potash soap spirit for applications. Recommended for ephelides.

℞ Spir. jasmin.,
" cassiæ,
" rosæ, ... ää ℥ i.
" flor. aurant., ... ʒ vi.
" tuberos.,
" vanill., ... ää ℥ ss.
" ambræ, ... ʒ vi.
Sapon. alb. pulv., ... ℥ ij.
Potassii carb., ... ℥ ss.
Aq. rosæ, ... ℥ i.
M. S. Essence fine de savon.

℞ Sapon. alb., ... ʒ ij.
Spir. vini rect., ... ℥ i.
Aq. rosæ,
" naphæ, ... ää ʒ ij.
M. S. Soap-essence.

℞ Sapon. kalin., ... ℥ vi.
Spir. vini rect., ... ℥ iij.
Glycerini, ... ℥ vi.
Borac. venet., ... ʒ ss.
Ol. cort. citr.,
Ol. santali, ... ää q. s.
M. S. Borax soap spirit.

℞ Zinci oxid.,
Talci veneti, ... āā ʒ ij.
Sapon. kalin. alb., ... ℥ iij.
Ol. millefl., ... gtt. x.
Ol. geranii, ... gtt. v.
Ess. bouquet, ... ʒ ss.
M. S. Cosmetic soap.

℞ Saponis kalini, ... ℥ iij.
Adipis suilli leni calore liquefacti, . ℥ iss.–℥ iiss.
Glycerini, ... ʒ iiss.
M. S. Potash soap with an excess of fat (Liebreich).

℞ Saponis kalini, ... ℥ iij.
Lanolini leni calore liquefacti, . . . ℥ iss.
M. S. Potash-soap with an excess of fat (Liebreich).

Besides these I shall give a few formulæ of soaps which can be had in the shops, some being officinal:

℞ Sebi bovini,
Terebinth. venet.,
Liq. sodæ caust., ... āā ℥ iss.
Calefaciendo paretur sapo, cui adde:
Ol. de cedro, ... ʒ iij.
Fiat frust. pond., ... ℥ iiiss.
S. Turpentine soap (Auspitz).

℞ Ol. cocos,
Sebi bovini,
Liq. sodæ caust., ... āā ℥ iss.
Camphor. in oleo solutæ, ... ℥ ss.
Fiat via frigida sapo pond., ... ℥ iiiss.
S. Camphor soap (Auspitz). For perniones.

℞ Ol. cocos,
Sebi bovini,
Liq. sodæ caust., ... āā ℥ iss.
Ol. rosmarini, ... ℥ i.
Fiat via frigida sapo pond., . . . ℥ iiiss.
S. Rosemary soap (Auspitz). To be used in aromatic baths.

If in place of ol. rosmarini, resina benzoini in alcol. solu. ℥ ss. be taken, a benzoic soap is produced, useful for the same purposes as the other.

℞ Potassii carb.,	. . . . .	Oiiss.
Calcariæ ustæ,	. . . . .	Oiss–ij.
Aquæ,	. . . . .	q. s.
Adipis suilli,	. . . . .	Ox.
Spir. vini rect.,	. . . . .	Oi.

Coctis adde:

Glycerini,	. . . . .	Oiv.
M. f. Sapo. pond.,	. . . . .	Oxx.

S. Salve soap (Dieterich).

Little is to be said of the manner of using soap. It may merely be remarked that the action is increased by rubbing, and that this is to be done with flannel, cambric, or a brush. In bathing, soap is to be dissolved in the water of the bath, or soap essences and alcoholic solutions are to be added to it. As to its local application, when it is wished to produce a marked loosening of the epidermis and the swelling and solution of the superficial layers, the mere washing with soda soap will not suffice. The soap must remain some time in contact with the skin. The soap may be rubbed on, using a small amount of water, and the lather may be allowed to dry in; or applications of soap dissolved in alcohol, and soft soaps spread on flannel or linen, may be used on the parts affected. It should be washed off in the bath or under a douche after one or more days. In all these cases, the after-treatment of the irritated skin with mild, soothing salves must not be neglected. Medicamented soaps are used in the same manner. The methods of using soap on the hairy scalp and in the mouth will be described further on.

As has been stated, the skin of many individuals does not tolerate the ordinary use of water. Still more frequently is soap not tolerated, even the mildest soda soap. In such cases the skin is to be cleansed by means of fats.

Fat.

If fat is rubbed on the skin, it makes this slippery, soft, and pliable. Fluid fats, or such as are rendered fluid by the heat of the skin, are absorbed into the superficial layers of the epidermis. This becomes clearer and glossy, and any existing rawness or roughness of the skin is removed, and an abnormal

tension is prevented. After the continued application of fats they may be absorbed by the skin (through the hair follicles, Lassar) and carried into the blood through the medium of the lymph-vessels. In this manner is to be explained the increase in bodily weight and the improved appearance after the methodic inunction of fat. A second property of fat is that of lessening the amount of water given off by the skin, since it forms a thin, impermeable coating which prevents evaporation. This water-tight covering protects the skin from external influences, such as moisture and the low temperature of the air; it serves as a protecting agent, and fats are in fact the best agents for protecting the skin. The secretion of the sebaceous glands and the fatty acids of the sweat are soluble in fat; the dirt of the skin is suspended in this solution as with soap, and in some cases the rubbing with oil or another fat may be sufficient to cleanse the skin and take the place of washing. Finally, the fats are of importance for cosmetic purposes, since they serve as a menstruum for many medicaments.

The fats are used to protect the skin and the complexion against atmospheric influences, to make the skin slippery and so prevent the rubbing of adjacent portions of the skin, to hinder the secretion of sweat, which loosens the epidermis, to prevent the skin, as that between the toes, from becoming sore; it is also used as a coating to cause the sticking of powders, and as a cleansing agent to remove dust and cosmetics from the skin.

Inunctions of proper fats should have a more general use than they have at present. The ancients recognized their value, and the anointing of the body with oil in the gymnastic games was not only a trick to make the body more difficult for the opponent to grasp, but served as well to increase the manly beauty, just as the inunctions of œsypus (lanolin) not only made the massage after the bath more easy and protected the body from the cold, but preserved for the Greek and Roman ladies the beauty of their skins to a ripe age. Beyond the anointing of the face and hands, we are entirely unacquainted with this custom. It should become popular again, at least in so far as to having a light massage with a proper fat after the weekly warm bath.

The exclusive employment of fat as a cleansing agent leads

finally to results exactly contrary to those desired. In place of a fine, pure complexion being produced, the skin becomes irritated, red, and raw, partly from the turning rancid of the fat, partly on account of the impossibility of completely removing the dirt. The never-washed Italian lady of Athenæus (*Μήποτε λελουμένη Ιταλία*) is still to be found among our society ladies.

Fat is contra-indicated as a cosmetic where the skin itself contains much fat, and where the secretion of the sebaceous glands is abundant and there are comedones, since the fats, especially those which harden readily, may easily stop the orifices of the sebaceous glands.

Of the fats, the following are used for cosmetic purposes.

Animal fats: pork lard, adeps suillus, axungia porci, is made by melting and filtering the spleen and kidney fat of the pig, and is white and salve-like; when pure it is odorless and melts at 100°. For cosmetic purposes it must be entirely odorless and free from free fatty acids. To have it in this condition, it is melted with sodii chloridum and albumen, filtered, and after being cooled, washed while being kneaded. Its permanency is increased when it is warmed with coarsely powdered benzoin (4:100), axungia benzoata.

Beef and mutton tallow, sebum bovinum et ovile, are the fats of the cow and of the sheep prepared like lard. The former is white, peculiarly-smelling, hard, and melts at a temperature of 100° to 115°. The latter is harder, has a stronger odor, and melts at 115° to 125°. The purification of tallow for cosmetic purposes is more difficult than that of lard.

Lard is used in pomades of soft consistence, tallow in those which are harder.

Cetaceum, from the semi-fluid matter of the head of the whale. The separating fatty part is pressed out cold and purified by washing and meting. It forms crystalline leaf-like masses, white, melting at 120° to 130°, soluble in oil. It does not become rancid.

An animal fat less often used is beef marrow, medulla ossium bovis, of salve-like consistency.

Lanolin, while chemically not a fat, since it does not consist of the glycerides of fatty acids, is still to be mentioned here, because it acts on the skin like a fat. It is made by emulsifying wool fat, wool sweat of the sheep, œsypus of the ancients,

with alkalies, treating this in a centrifugal machine and further purifying it. Free from water, it is yellow and transparent, melting at 98° to 105°. After the absorption of twenty-five per cent of water, it becomes a yellowish-white, salve-like mass, with an odor which, though feeble, always recalls its origin. This lanolin with water can still, if it be kneaded, take up more than its weight of water, without losing its salve-like consistency. Chemically, lanolin is a mixture of cholesterin and ethers of the fatty acids. It forms a permanent emulsion with water and small quantities of alkaline carbonates or borax. For cosmetic purposes only that lanolin should be used which is free from fatty acids. Agnine, manufactured in America, contains thirty-three per cent of free fatty acids.[28] On the skin, its action is similar to that of the animal fats; the skin, however, absorbs lanolin more readily than these, perhaps because, as Liebreich has shown, cholesterin fats are formed even in the horny cells. Under the use of lanolin, the skin becomes tenser and more turgid, as after the inunction with other animal fats. Whether drugs mixed in the lanolin are more quickly absorbed by the skin than in other salves, is still an open question. It has, however, one great advantage over all other salve menstrua, in that it does not become rancid.

The vegetable oils used are as follows.

The fluid oils: almond oil, oleum amygdalarum dulcium, obtained from sweet almonds by cold pressure, being settled and filtered, is a yellow oil, very mild and of a peculiar delicate odor.

Olive oil, oleum olivarum, obtained by cold pressure from fresh olives, is clear, pale yellow, and very mild.

Ben-nut oil, from the seeds of the moringa tree, obtained by cold pressure, is entirely odorless and almost colorless, and does not easily become rancid.

Besides these, sesame oil and hazel-nut oil are occasionally employed.

The hard oils: Palm oil is obtained from the fruit of the oil palm in tropical Africa. At the ordinary temperature it is of the consistence of butter, of orange-red color, and of agreeable, violet-like odor when fresh, but loses its color when kept and easily becomes rancid.

Cacao butter, oleum cacao, obtained by warm pressure

from the hulled and slightly roasted cacao beans, is of a yellowish-white color when fresh, later white, solid, brittle, having a peculiar odor, and melting at 85° to 95°. It is very permanent.

Wax, cera, is obtained from the honey-comb by pressing out the honey, washing and melting, and is a brittle, granular, yellow or yellowish-brown mass, having the odor of honey and melting at 130° to 140°. By melting and bleaching, it becomes white wax, cera alba, which is purer than the other and melts less readily.

Of the so-called mineral oils the following carburetted hydrogen oils are used: The fluid paraffin or vaseline oil, a clear, colorless, odorless fluid, somewhat thick, obtained from petroleum, and which does not become rancid.

The salve-like vaseline, also obtained from petroleum or its products of distillation. The color and the melting-point vary according to the manner of manufacture and the locality from which it is obtained. The American vaseline is dark orange-yellow in color and melts between 90° and 98°; the Austrian is honey-yellow; the German is white, either gritty or tough, and has a bluish reflex. Vaseline should be odorless. Often it shows an acid reaction remaining after its purification, and is therefore of no use for cosmetic purposes.

Finally, there is the solid paraffinum solidum, a substance obtained from ozokerite or peat, of whitish-blue color, transparent, of waxy consistence, odorless, melting at 160° to 175°.

Besides these, there are fatty seeds which may be used either pulverized or in the form of an emulsion. Sweet and bitter almonds are those most frequently used, the latter because of their pleasant odor. The bruised almonds, with their original fat or the refuse material after the oil has been pressed out, is ground up and used under the name of almond bran, which is still rich in oil. Cocoa and pistachio nuts are used in a similar way.

Cucumber juice, obtained by pressing the fresh cucumber, containing its fatty seeds, is also used.

The rule holds for all pure oils that they must be entirely inodorous if they are to be used on the skin. The pure oils are seldom used alone, but different preparations and mixtures are employed according to the place and the manner of their application.

For rubbing on the skin after the bath and for massage, we should use chiefly the vegetable oils and the animal fats alone or mixed, but always in a semi-fluid or salve form, possibly containing a small quantity of perfume. The best agent for this purpose is lanolin in the following form:

℞ Lanolin anhyd., ... ℥ iij.
Ol. cacao, ... ℥ i.
Vanillin, ... gr. viij.
S. Pomade.

℞ Lanolin, ... ʒ iij.
Sod. bor., ... gr. xvi.
Aq. rosæ, ... ℥ iiiss.
S. Lanolin milk, a very permanent emulsion.

A very popular and valuable salve mixture is cold cream, crême céleste or unguentum emolliens of the Austrian Pharmacopœia. By crême is understood a mixture of wax, cetaceum, and almond oil to which water, pure or aromatic, often glycerin or vaseline, and also potassii carbonas, sodii boras, and tinctura benzoini are added. The crême céleste of the Austrian Pharmacopœia consists of cetaceum, 2 parts; cera alba, 1 part; ol. amygdal., 8 parts; aq. rosæ, 2 parts. The fats are first melted and the water mixed in when the mass is half cold. It is then stirred until it becomes white and foamy.

℞ Olei viol. odor.,
Aq. viol., ... āā ℥ xvi.
Ceræ, ... ℥ i.
Spermaceti, ... ℥ i.
Essentiæ amygd., ... gtt. v.
M. S. Cold cream à la violette.

℞ Ol. amygd. dulc.,
Aq. rosæ, ... āā ℥ xvi.
Ceræ,
Spermaceti, ... āā ℥ i.
Camphoræ, ... ℥ ij.
Essent. rosmarini, ... ʒ ss.
M. S. Camphor ice (Piesse[24]).

If glycerin be substituted for aq. rosæ in the last recipe, we have glycerin cold cream, which is very permanent.

℞ Spermaceti, ... ℥ ss.
Ceræ alb., ... ʒ ij.
Ol. amygd. dulc., ... ℥ iiss.
Butyr. cacao, ... ℥ ss.
Pulvis viol., ... ʒ i.
Træ. ambræ, ... ʒ i.
M. S. Cacao crême (Débay[25]).

℞ Ceræ alb.,
Cetacei, ... ää ʒ iss.
Ol. amygd.,
Succ. cucum. rec. press., . . . ää ℥ iiiss.
Træ. cucum. e succ. (4:5 spir. vini. rect.), ℥ ss.
M. S. Cucumber pomade (Bernatzik).

℞ Axungiæ, ... ℥ viij.
Cucumer.,
Melonum concis., ... ää ℥ xvi.
Succ. citri, ... ℥ iv.
Fruct. mali (reinette), ... gr. xxx.
Lactis vaccin., ... ℥ ij.
Calef. in balneo Mar. 5 hor.; cola.
M. S. Pommade des concumbres (Débay).

℞ Ceræ albæ,
Cetacei, ... ää ʒ ij.
Ol. amygd. dulc, ... ℥ ij.
Vaselini,
Aq. rosæ, ... ää ʒ v.
Borac. ven., ... gr. xvi.
Ol. rosæ, ... gtt. ij.
I. S. Cold cream.

℞ Cetacei, ... ʒ iij.
Ol. ricini, ... ℥ ij.
Ol. amygd., ... ʒ v.
Ol. odorat., ... ♏ xvi.
M. S. Ice or crystal pomade (Bernatzik); a transparent gelatinous pomade.

℞ Ol. cocos., ... ℥ iss.
Aq. rosæ, ... ʒ i.
Ol. rosæ, ... gtt. i.
M. S. Cold cream (Hager[26]).

The last prescription most resembles the original cold cream, which consists of

℞	Ol. cocos, ...	℥ i.
	Ol. rosæ, ...	gtt. viij.

and is not equalled by any of the other creams if the ol. cocos be fresh and of good quality.

Almonds and other fatty seeds are used in powder as almond bran alone or mixed with other oils; as washing powder when mixed with soaps, alkalies, or sodii boras; and as pastes and emulsions. These are very mild fatty and washing agents and render the rough, raw, dry skin of the face and hands tender and flexible, and at the same time cleanse it thoroughly. They are also entirely harmless.

℞	Amygd. amar. decort. cont., . . .	℥ viij.
	Mellis, ...	℥ xvi.
	Vitell. ovor., ...	No. viij.
	Ol. amygd. dul., ...	℥ xvi.
	Ess. bergam.,	
	" caryoph., ...	ää ʒ ij.

M. S. Honey almond paste.

℞	Amygd. am. decort. cont., . . .	℥ xxv.
	Aq. rosæ, ...	℥ xxviij.
	Alcoholis, ...	℥ xv.
	Ess. bergam., ...	℥ iij.

M. S. Almond paste.

℞	Farin. amygd. decort., ...	℥ xxxiij.
	Rad. irid. pulv., ...	℥ ij.
	Ess. citri., ...	℥ ss.
	" amygd., ...	♏xv.

M. S. Almond meal.

℞	Pistac. decort. cont., ...	℥ xvi.
	Pulv. iridis, ...	℥ xvi.
	Ess. neroli, ...	♏xxx.
	" citri, ...	℥ ss.

M. S. Pistachio meal.

℞ Farin. amygd. decort., ... ℥ xvi.
Amyl. oryz., ... ℥ iv.
Pulv. irid. flor., ... ℥ iss.
Sapon. pulv., ... ℥ iss.
Ess. amygd., ... gtt. xx.
M. S. Almond powder.

℞ Semin. excort. hippocast. pulv., . . ℥ iiiss.
Amygd. amar. pulv., ... ℥ iss.
Rhiz. irid. flor., ... ℥ iss.
Sod. carbon. dil., ... ʒ iij.
Ol. bergam., ... ♏ xxx.
M. S. Washing powder for rough and chapped hands (Wiegleb-Hager).

℞ Amygd., ... ℥ ss.
Cont. misc. c.
Aq. flor. aurant.,
" rosæ, ... āā ℥ ij.
Col. expr. adm.
Sodii bor., ... gr. xvij.
Tinct. benzoini, ... ♏ xxx.
M. S. Eau cosmetique de Vienne (Bernatzik[27]).

℞ Farin. amygd. amar., ... ℥ vi.
Ol. amygd. amar., ... ℥ iiiss.
Mellis, ... ℥ xij.
Vitell. ovor., ... No. viij.
Sod. carb., ... ℥ i.
In Aq. rosæ q. s. solut.
Ft. pasta (Débay).

℞ Amygd. dulc. decort., ... ℥ viij.
Aq. rosæ, ... ℥ xix.
Succ. rad. taraxac. expr., ... ℥ i.
Spir. tuberos., ... ℥ viij.
Ol. virid.,
Ceræ,
Sapon. oleac., ... āā ℥ ij.
M. S. Lait de Pissenlit (dent-de-lion, Piesse).

℞ Cer. alb.,
Cetacei,
Ol. amygd.,
Sap. amygd., ... ää ʒi.
Subigr. c. Spir. vini rectif., ... ℥iss.
Admisce emuls. par. e.
Amygd. dulc., ... ℥ss.
Ad Aq. rosæ,
Aq. fl. naphæ, ... ää ℥v.
M. S. Lait de lilas (Bern.).

The application of fat to the skin is most frequently made by rubbing it in lightly with the hand; for the face it is better to use a fine cloth, by means of which only a small amount of the fat is rubbed into the skin; the hands are salved by the motions of ordinary washing. Face and hand pomades are best used in the evening, after the skin has been washed and thoroughly dried. In most cases where fat is indicated—that is, when the skin is rough, dry, and dull—the pomade used should be wiped off with a cloth so that only a thin, scarcely perceptible layer is left on the skin. Powder is often dusted over this layer of fat and serves to retain it.

In order to have the fat act more effectually on the skin or to prevent the soiling of the clothes and bed linen, the anointed spots are sometimes covered with light woollen stuff or doeskin. The hands are often oiled and then gloves drawn on and worn either all day or only during the night. The gloves, which should be suède or of doeskin, may be themselves treated with oil or a mixture of almond-oil and yolk of egg. In the first case, the glove is turned wrong side out and coated with a fairly solid salve. In the second, the glove is kneaded in the mixture and then kept in a cool place. The preparations of almond or other oily seeds are used either as washing agents or as combined washing and oiling agents. The almond powder and the thick almond paste are mixed with water and a thin paste made, which may be applied to the face and hands at night, and wiped off with a cloth or washed off with water in the morning.

Associated with the fat on account of its origin is

Glycerin.

It is a clear, odorless, colorless, neutral, syrupy liquid, sweetish in taste, which dissolves readily in water, mixes with alcohol and etheric alcohol in all proportions, and is insoluble in ether, chloroform, and the fatty oils. In the saponification of the fats, which are glycerides of the fatty acids, glycerin is set free, and is found in the excess of lye in the soaps, and in water which has been used for washing. It is obtained for the most part by the breaking up of fats by means of overheated steam, as in the manufacture of stearin candles. Glycerin is markedly hygroscopic, absorbing as much as fifty per cent of water from the air. It is of special importance on account of its physiological action. Rubbed briskly into the unbroken skin, it causes redness and burning, which is more severe in parts not covered by epidermis, as cracks and fissures in the skin of chapped hands. The burning is caused by the abstraction of water from the skin. Since it does not dry, and forms a regular slippery coating over the skin, it was used in practice, immediately after its introduction, to take the place of the oils. It permeates living animal tissues very readily, and makes these succulent and translucent. It is to be used for this purpose only conditionally, since in many cases not only is an eczema or chapping of the skin made worse, but even a naturally delicate skin is made rough, fissured, and lustreless. For many persons the inunction of glycerin is much more unpleasant than the inunction of oils. Many individuals bear it exceptionally well even on a diseased skin, and especially well when combined with oils or mucous substances.

Its employment for lessening the corroding action of soaps and as an ingredient of soap in general has been spoken of above. Aside from its peculiar cosmetic action, glycerin is much used in cosmetics as a non-drying menstruum in which a number of substances may be dissolved. If it be used alone for cosmetic purposes, it must be entirely pure, free from fatty acids, such as formic and butyric acids, and acrolein, and be applied much diluted. Its supporters say that under its use the skin takes on a high degree of flexibility, softness, and lustre, and that it frees the skin from dirt; they recommend its use as a washing and protecting agent when the

skin is raw, fissured, lustreless, and scaly, and when the lips and nipples are sore.

The manner in which glycerin is commonly used by persons who desire smooth hands is very rational. After washing, while the hands are still damp, diluted glycerin is poured on, and the hands are then dried.

℞ Glycerini, ... ʒ vij.
Vitell. ovor., ... ʒ vi.
M. S. Salve for chapped lips and hands (glyconin).

℞ Glycerini, ... ℥ xvi.
Aq. naphæ, ... ℥ viij.
Ol. neroli,
Ol. amygd. amar., ... ää gr. vij.
M. S. To be rubbed on the hands.

℞ Tragacanth. pulv., ... ʒ iij.
Aq. rosæ, ... ʒ vi.
Glycerini, ... ℥ iss.
Tinct. benzoini, ... ʒ iij.
Ol. aurant. flor., ... gtt. v.
M. S. Glycerin paste to be used in place of soap for washing the face and hands (Hager).

℞ Ceræ flav.,
Cetacei, ... ää ʒ i.
Ol. amygd., ... ʒ vi.
Sodii bor., ... gr. xvi.
Acid. benzoini, ... gr. viij.
Sol. in
Glycerini, ... ʒ ij.
Aq. destil., ... ♏ xxiv.
Ol. rosæ, ... gtt. ij.
F. massa mollis (Hager). S. For raw skin, fissures, and chilblains.

The glycerin is the important agent in the unguentum glycerini, which is prepared from tragacanth (German Phar.) or wheat starch and glycerin by warming. The irritating action of the glycerin is almost wholly wanting in this fine transparent salve. The following may be used for cosmetic purposes in the same manner as cold cream:

℞ Amyli, ... ʒ i.
Aq. rosæ, ... ʒ i.
Glycerini, ... ℥ iij.
Ol. rosæ, ... gtt. ij.
F. ungt. S. Glycerin cold cream.

Alcohol.

As a cosmetic agent to preserve the lustre and freshness of the skin, alcohol is valuable, almost indispensable. This is not true of absolute or slightly-diluted alcohol. Ethyl-alcohol undiluted extracts water from the skin and renders it dry and rough; it also dissolves the secretion of the sebaceous glands and so removes the fat of the skin and consequently its lustre. When the skin is washed with alcohol, its evaporation produces a pleasant feeling of cold. If its evaporation be prevented, it irritates the skin and reddens it. This condition of irritation may be intense, or may become an actual superficial dermatitis, since the alcohol is absorbed by the external skin and acts as a foreign body on the deeper layers. For this reason concentrated alcoholic fluids are seldom used as cosmetics, and only when the skin of the face is unusually oily, or to remove the sweat and fat from the hairy parts of the body. Dilute alcoholic fluids may be used as applications to contused spots; also to wash an eczema madidans and in habitual hypersecretion of sweat. Diluted with three or four times its bulk of water, alcohol serves as a beautifying agent for preserving a fresh and rosy complexion.

Pure alcohol is seldom used for this purpose, but usually it forms the menstruum for the perfumes of toilet-waters, and is occasionally used in the form of wine which is poor in alcohol. The employment of the latter, as well as of the more concentrated alcoholic fluids, is for the purpose of making the skin tenser and of increasing its tone. Bathing with cognac and eau de cologne is indicated in fainting, both because of their intense odor and on account of their tonic action on the skin. Bathing the eyes, cheeks, and wrists is always successful, except in very severe cases. When alcohol or alcoholic tinctures are used for washing, only a small quantity is poured into the water, so that the alcohol has but little effect; when

wine is used, the alcohol has a more considerable action. The action of the alcohol is only got in local bathing of the hands, the breast, the back, etc., with wine; with red wine the tannic acid present is also active. The accounts of the use of undiluted wine for full baths are merely legendary, as for example in the case of one of the most famous singers of our day, who talked of the champagne baths which she enjoyed in the time of her pregnancy.

The Alkalies.

The only alkalies which have a cosmetic use are the oxyhydrates of potassium and sodium and the carbonates of these, and sodii boras in which the action of the acidum boricum is to be considered.

To this group belong also the combinations of potassium and sodium with sulphur, caustic lime, calcii sulphidum, and the soluble calcium salts, as well as the rarely-used ammonia combinations.

The action of the alkalies depends on their power of abstracting water from the tissue, of precipitating living albumin, of dissolving keratin, horny substances, and mucin, and of loosening and destroying tissue and even dissolving it.

The caustic action of the oxyhydrates of the alkalies and of calcium depends upon their property of abstracting water, and on the reaction to living albumin. They are, therefore, in a narrow sense, not cosmetics. The physician occasionally uses one of these agents for removing a wart or a corn, though more suitable remedies are mostly employed; but since unpleasant results may follow the application of dilute solutions of these for cosmetic purposes, it is well to say a word about their caustic properties. After their application the epidermis softens, and after a short time an eschar is formed much larger than the spot to which the agent was applied, since it flows freely; and with the formation of this eschar a severe burning is felt. When caustic lime is used the eschar is not so large. The oxyhydrates of the alkalies have the strongest caustic action; the simple carbonates act in a similar manner, but much less severely.

When, under the application of dilute alkalies, the outer layers of the epidermis become dissolved, further applications irritate the underlying tissues and cause a new formation of cells. Dilute alkalies may also saponify the fatty secretion of the skin and thus serve partly as a cleansing, partly as a curative agent, since they prevent the stopping of the sebaceous follicles and the formation of comedones. In many persons these will remove the oily gloss of the skin; and finally, by combining with free fatty acids they may remove the disagreeable odor of the sweat and other secretions of the skin. All these properties make these not only valuable cosmetic agents, but adapt them for preparatory treatment.

The caustic potassa and soda, on account of their strong caustic action, are to be applied only by the hand of the physician, and are even then but rarely used for the removal of warts and callosities. They are occasionally used diluted for the gradual removal of corns and pigment spots.

The alkaline carbonates, because of their lesser caustic action, are much more frequently used for cosmetic purposes. They serve to remove the fat from the skin and so prevent acne, and they remove also the fat from the hair. Since they cause swelling and casting off of the superficial layers of the skin, they are used to cure warts and corns, and are applied to thickened misformed finger-nails. They are also used for the removal of freckles and similar small pigment spots; they have, however, no bleaching action, and the cure, as with other agents, is apt to be merely temporary.

The continued use of the alkaline carbonates makes the skin and the scalp dry, rough, and sensitive, and the hairs become dry and brittle. They are, therefore, contra-indicated when the skin is delicate, thin, or sensitive. Cosmetic errors, such as dandruff formation, for which these agents are employed, may even be caused by them. The nature of the affection should first be considered.

℞ Potassii carbon., ... ʒ ss.
Tinct. benzoini, ... ʒ iij.
Aq. rosæ, ... ℥ iiiss.
M. S. Add one tablespoonful to the wash water.

℞ Potas. carb., ... ʒ iij.
Aq. destil., ... ℥ iiiss.
Ol. æth. cinnam., ... gtt. ij.
" " rosæ, ... gtt. i.

M. S. (Substantially the same as the proprietary remedy Lilionèse.) To be used with a damp sponge for hypersecretion of fat from the skin; useful in comedo and acne.

℞ Sodii carb., ... ʒ i.
Aq. rosæ, ... ℥ iiiss.
Glycerini, ... ℥ iss.
Extr. mille flor., ... gtt. x.

M. S. For washing the face when oily, and in acne.

℞ Potassii carb., ... ʒ ss.
Sod. silic., ... ʒ i.
Sapon., ... gr. xvi.
Muc. gum. arab., ... ʒ i.
Glycerini, ... ʒ iij.
Aq., ... ℥ iiiss.
Ess. mirobolan., ... gtt. v.
Ol. neroli, ... gtt. ij.

M. S. Birch balsam (Dr. F. Lengyel's proprietary remedy).

℞ Potassii acet., ... gr. xvi.
Aq. destil., ... ℥ iss.
Spir. vini rect.,
Ol. rosæ, ... ad lib.

M. S. Kimball's remedy for freckles.

To this group belong a number of proprietary remedies which are in reality solutions of potassii carbonas, and are recommended as specifics against freckles, pigment and erythematous spots. The manner of their application is simple. Concentrated solutions are either added to the wash water or applied to the skin with a moist sponge. Dilute solutions can be used for washing the skin, or cloths dipped in these may be laid upon the skin and left there, perhaps, during the night; remedies for removing freckles are generally used in this way. This method may be used for the removal of corns and callosities if concentrated potash lyes are employed, if one does not prefer to remove these growths with pumice-stone dipped in lye, as many of the "corn operators" do.

With the potassa preparations should be classed the potassa crême (when it is not simple potash soap), which according to its concentration is numbered 1, 2, 3,4.

℞ Glycerini, ... ʒ iss.
Ol. rosæ,
Ol. flor. aurant., . . āā gtt. ij.
Potassii carb. solut., . . ʒ ss.– ʒ i.– ʒ ij.– ʒ iv.
M. S. Potassa crême (Kaposi). To be used in the form of poultices for freckles, etc.

℞ Pot. caust. fusi, ... ʒ i.
Aq. dest., ... ℥ iij.
M. S. Add to a quart of warm water, as a foot or hand bath in extensive callosities.

Aqua calcis acts in a similar way, but more mildly. Combined with equal parts of ol. lini or ol. olivar., it is a popular remedy for burns. In fissures of the skin and chapped hands it may be used as follows:

℞ Tragacanth. subt. pulv., ... ʒ iij.
Glycerini, ... ℥ iss.
Aq. calcis,
Aq. rosæ, ... āā ℥ iiss.
M. S. To be painted on in the affections mentioned and in sore nipples.

The caustic lime is mixed with caustic potassa or used alone as a caustic agent on warts and pigment nævi, and accasionally for destroying large pigment blotches.

℞ Potas. caust. sicci, ... ℈ ij.
Calc. ust., ... ℈ i.
M. f. bacilli. S. Caustic points to be used on corns, etc.

℞ Calcar. hydr.,
Sapon. oleac. pulv., ... āā ʒ i.
Spir. sapon., ... ʒ ss.
M. f. pasta mollior. S. To be left on for eight to ten hours and then removed.

℞ Potassii carbon., ... gr. xvi.
Borac. venet., ... ʒss.
Solv. in
Aq. rosæ,
" rub. idæi,
" colon., ... āā ℥ss.
Filtr.; adde
Talc. venet., ... ʒ iij.
M. S. Lilionèse, another prescription (Neumann).

℞ Potas. carb., ... ʒ iij.
" chlor., ... ʒ iss.
Borac. venet., ... ʒss.
Aq. rosæ,
" naph., ... āā ℥ iss.
Sacch. alb., ... ℥ iss.
Glycerini, ... ℥ i.
Filtra. S. Water for freckles.

℞ Sodii bor., ... ʒss.
Aq. rosæ,
Aq. fl. naphæ, ... āā ʒ iiiss.
M. S. Water recommended by Hufeland for freckles.

℞ Borac. venet., ... ʒ i.
Ungt. emoll., ... ℥ iss.
M. f. ungt. S. Cream for making the hands white and soft.

℞ Amygd. amar., ... ʒ ij.
F. c. Aq. rosæ, ... ℥ iiiss.
L. a. emulsio; adde
Sodii bor., ... ʒ i.
Træ. benzoin., ... ʒ iiss.
M. S. Toilet water.

℞ Aq. fl. naphæ, ... ℥ xxxiij.
Glycerini, ... ℥ iss.
Sodii bor., ... ʒ iss.
M. S. Lotion à la glycerine (Piesse).

℞ Borac. venet., ... ʒ i.
Potas. chlor., ... gr. xvi.
Spir. resed., ... ʒ ss.
Aq. rosæ,
" naphæ, ... āā ʒ vi.
M. filtra. S. Water for freckles (Neumann).

℞ Amyl. oryzæ, ... ℥ i.
Sodii bor., ... ʒ iss.
Aq. colon., ... q. s.
M. f. p. S. Powder.

℞ Borac. venet., ... ʒ ss.
Lact. vaccin., ... ℥ iiiss.
Extr. de roses-thé, ... gtt. x.
M. S. Milk for washing the face at night.

Borax is one of the best cosmetic agents. Its advantages consist not only in its entire harmlessness, but also in its very mild action, which, though similar to that of the dilute alkaline carbonates, has still an individual action like that of a neutral soap. Washing with solutions of sodii boras is almost never contra-indicated. To obtain the desired effect, a solution as nearly concentrated as possible should be used. It dissolves in twelve to fifteen parts of cold water. It is pencilled on the skin and left to dry, or fomentations are made with it. For the cure of ephelides, or of moderate seborrhœa of the face, one of the previously-mentioned waters should be used. In hyperidrosis, cold applications of five to eight per cent solutions of sodii boras, foot-baths with this, and the use of a powder like the following are recommended:

℞ Alumin. plumosi, ... ℥ iv.
Sodii bor. pulv., ... ℥ i.
M. S. Dust into the stockings.

Salves of borax are indicated when the skin is dry and cracked and when there is visible exfoliation.

Acids.

The agents previously mentioned are mostly cleansing agents; they may have at times, however, a curative action also. The acids are not indifferently-acting substances, and

most of them require care in their employment, although many have long been used by the laity for cosmetic purposes. In the local application of the acids, the degree of concentration is of importance. Concentrated mineral acids coagulate the albumin, abstract water from the tissues, oxidize and destroy them more or less deeply and extensively.

The destroyed tissue and the combinations which the acid makes with it form at the spot of application an eschar, which varies with the different acids. Organic acids have a similar effect. The eschar after the use of acidum sulphuricum is moist and brown; bright yellow and dry after acidum nitricum; yellowish-brown and dry after acidum chromicum. Lactic acid produces a gray or brown moist eschar; the acetic acids a white eschar, often red or brown on its surface from superficial extravasations of blood. Acidum salicylicum forms a white eschar, and phenol, which may be put here on account of its similar action, forms a white eschar, later becoming leathery-brown. The color of the eschar is to be considered when applications are to be made to the face or scalp. The acids are used for the removal of nævi, warts, callosities, and papillomata. After their careful application, only superficial cicatrices remain. Care must be taken of the surrounding skin when fluid mineral acids are employed, and this must be protected by plaster, or the fluid must be dropped a drop at a time on the spot wished and not be allowed to spread. In this manner are to be used concentrated acidum sulphuricum, fuming acidum nitricum, acidum lacticum, acidum aceticum, acidum carbolicum, and crystallized acidum chromicum or concentrated solutions of the latter. In using concentrated solutions of acidum salicylicum, the healthy skin must be protected, since this, like the other acids mentioned, irritates the skin and causes inflammation and the formation of vesicles.

These unpleasant symptoms are often observed after the use of tourist's plaster (salicylate adhesive plaster), or salicylate gutta-percha plaster, when the corn or callosity is not so much affected as the surrounding skin, which is raised in the form of a white blister.

Intelligently applied, acidum nitricum and acidum chromicum, as well as acidum lacticum and acidum aceticum, act mildly.

For caustic purposes these acids are applied with a glass

rod, *e.g.*, acidum sulphuricum, or with a stick, *e.g.*, acidum nitricum, or are made up into the form of convenient pastes and salves. Such are the mixture of concentrated acidum sulphuricum with carbon, the acidum sulphuricum solidificatum, jestingly called by Ricord pâte d'amandes douces, and a mixture of acidum nitricum with oil or adeps oleum, unguentum oxygenatum. Acidum chromicum is to be applied in crystals or in very concentrated aqueous solution; acidum lacticum and aceticum are to be used pure; acidum salicylicum in concentrated alcoholic solution or in collodion or gutta-percha plaster mull (20, 40, 50%).

℞ Acidi chromici, ... 3 iss.
Aq. destillat., ... 3 iij.
M. S. Apply with a glass rod to flat warts.

℞ Acid. salicyl., ... 3 i.
Alcoh. absol., ... 3 v.
M. S. To be painted on nævi with a brush.

As to the manner of application, it should be said that corns and callosities are first to be softened by warm baths, soda or potash being added in some cases, then loosened with a dull knife, and finally acidum salicylicum or aceticum applied with a brush.

The loosening of the horny layers and the caustic effect are both gotten by the employment of acidum salicylicum in plaster form; after a few days of such application the warts may be lifted off, together with the plaster.

The acids are more extensively used largely diluted. Acidum boricum, tartaricum, and citricum are used in both concentrated and dilute solutions. Continued washing with these removes the fat from the skin, dries the epidermis, and makes the skin rough, dry, and fissured; longer application of stronger solutions causes superficial reddening of the skin and slight burning; when used for a short time only they act as astringents, increase the tone of the skin, and contract the superficial vessels.

These acids also lessen the secretion of the sweat glands, and prevent in part the decomposition of the sweat, thus preventing the odor.

They are used in practice to remove erythematous spots from the skin of the face, hands, and feet. The oldest and most

useful of these agents is vinegar: the toilet vinegars, aceta aromatica, vinaigres de toilette, are important agents in perfumery. The vinegar in perfumes, however, has little specific effect in the concentration which is generally used, little more is noticed than the stimulating odor.

Even in these small quantities, such as a teaspoonful to a basin of water, they have a certain therapeutic value when used daily, since they have an astringent action on the skin. For this reason, persons with a fine and sponge-like skin should use but little vinegar, which, as a rule, is chosen by persons with a coarser and stronger complexion.

These vinegars are usually bought from the perfumers; they may, however, be prescribed by physicians and prepared by the apothecaries. The first requisite of a toilet vinegar is that it must be pure and good, free from acetone and other impurities. Either vinegar or acidum aceticum may be used. The solution is formed by mixing dilute acidum aceticum with one or more flower water. Acidum aceticum in alcoholic solution, ethereal oils, or resinous and balsamic substances may be used as toilet vinegar; the ethereal oils and resins dissolved in glacial acetic acid may be added to the vinegars prepared with ethereal oils and balsamic substances, readily by adding water, and form fluids similar to milk (lait virginal).

[illegible]	℥ i.
[illegible]	℥ i.
[illegible] Hoffmanni,	
[illegible] dil.,	āā ℥ viij.
[illegible]	℥ v.
[illegible] dil.,	℥ ij.

M. et [illegible]. ; filtra. S. Vinaigre de toilette (Hager).

[illegible] conc.,	℥ ij.
[illegible] angl.,	gr. xvi.
[illegible] angl.,	gr. viij.
[illegible],	gr. viij.
[illegible],	℥ ij.

M. et [illegible]. S. Vinaigre aromatique (Piesse).

[illegible],	℥ xv.
[illegible] conc.,	℥ ss.

M. et [illegible]. S. Vinaigre de Cologne.

℞ Spir. vini rect., ... ℥ x.
Resin. benzoini, ... ℥ i.
Acet. arom. conc., ... ʒ ij.
Bals. peruv., ... ʒ ij.
Tinct. neroli, ... gtt. viij.
Tinct. nuc. mosch., ... gtt. viij.
M. S. Vinaigre cosmétique (Lubin).

℞ Fol. menth. pip.,
" rosmarini,
" salviæ, ... āā ʒ i.
Rad. angelic.,
" zingib.,
Caryophyll., ... āā ʒ i.
Aceti, ... ℥ iiiss.
Mac. p. 3 dies in vas. bene clauso. S. Acetum quatuor latronum s. aromaticum (Austrian Phar.).

℞ Bulb. narciss., ... ʒ iss.
Semin. urtic., ... ℥ i.
Aceti, ... ℥ xxxiij.
Mac. p. 3 dies, exprime; filtra. S. Vinaigre déterrif (Débay). For acne pustules of the face.

In order to remove blotches from the skin, these vinegars must be pencilled on undiluted, rubbed in, or used as applications. In place of these, lemon juice has long been used, which is painted on, or fresh slices of lemon are laid on the erythematous spots, chilblains, and freckles, and left during the night; dry, scaly eczema of the face is also treated in this way with good results.

Washing with acidum hydrochloricum or nitricum is also of service in these cases. James has used the former in the treatment of erythematous blotches and the various sorts of acne of the face. He uses for this purpose the liqueur styptique, a mixture of acidum hydrochloricum, alcohol, aqua rosæ and a gum, which is pencilled on the affected spot and lightly wiped off again with a bit of cotton, so that only a thin layer remains. The itching caused by this ceases in a few seconds, and the redness does not last over a half-hour. The spots are considerably paler even on the following day. In a similar manner Hebra, junior, used a two to five per cent solution of

acidum salicylicum or carbolicum; an equally strong salve of acidum salicylicum may be rubbed on the spot in the evening. The form of acid employed must vary according to the nature of the healthy skin of the individual. Acidum salicylicum is a less irritating agent than acidum carbolicum and tar preparations, in cases where formerly the latter were used, as in moist eczema of the face. According to Unna it has a marked dermoplastic action; it irritates, and stimulates in this way the new formation of the cellular elements of the cutis. The irritation which it produces prevents its extensive use as a cosmetic in the form of toilet water.

If the skin be once injured in this way by the acid, the further application of it is very painful. On the other hand, the removal of freckles and ephelides is only to be expected after an intense application of the acid. By rubbing the skin with alcoholic solutions of acidum salicylicum, it is inflamed, the superficial layers are cast off, and the spots vanish for a time.

℞ Acid. muriat., ... 3 ss.– 3 iiss.
Alcohol.,
Aq. rosæ, ... āā ℥ i.
Muc. gumm. arab., ... 3 i.

M. S. Liqueur styptique, after James. The weaker solutions are to be employed in the manner described for erythematous blotches, the stronger solutions for acne rosacea every second or third day. For the intervals the patient should wash with weakly alkaline water.

℞ Acid. salicyl., ... 3 ss.– 3 iss.
Spir. vini conc., ... ℥ iiiss.
Træ. neroli, ... gtt. iv.

M. S. Erythematous patches on the face are to be rubbed with a bit of cotton dipped into the solution, and then sprinkled with powder.

℞ Acid. salicyl., ... 3 ss.
Cold cream,. . . . . ℥ iiiss.

M. ft. ungt. S. A salve for erythema and light moist eczemas of the face. To be used after washing with soap, and to be followed by the dusting on of powder.

Partly on account of their anti-putrid properties, partly because of their sharp odor, the acids are used to prevent and

conceal the odor of local sweating. They are also used on the overheated skin, as in insolation, when there is no secretion of sweat, to replace this in cooling the skin and making it pale. Washing with dilute vinegar moderates the secretion of sweat and removes its odor if this be not too intense.

If the odor be very bad, or there be abundant secretion of sweat, as in the axillæ, on the feet, and about the genitalia, these washings are not sufficient. The opinion commonly held by women that highly perfumed toilet vinegars are to be used in such conditions is very erroneous. Apart from the ineffectiveness of the procedure against the hypersecretion, the mixture of the odor of the sweat and that of the perfume is unbearable, and the suspicion is at once aroused that the strong odor has been employed to conceal an offensive one.

Especially unpleasant for the patient and for his associates is the abundant sweating of the feet, which, as already said, is often offensive and a frequent subject of cosmetic treatment. Apart from other remedies which are used in local sweating, there are some acids in general use. These are acidum sulphuricum, acidum tartaricum, and acidum salicylicum. The first is used in the form of a foot-bath; acidum tartaricum is used as such or as cream of tartar, by itself or mixed with an indifferent powder, such as amylum and alumen plumosum, or in the form of a solution in which the feet are to be washed. The stockings may also be soaked in this solution and worn when dry.

The surest acting for sweating of the feet and axillæ is the acidum salicylicum, which is included in the officinal sweat powder of the German Pharmacopœia, pulvis salicylicus cum talco. In later times, washing with acidum chromicum has been recommended, not only, like the other agents mentioned, as a palliative remedy, but for the definite cure of the sweating. The experience with this remedy is still too limited to allow of a definite decision regarding it; the toxic properties of the acidum chromicum must not be forgotten, and it must not be used where there are breaks in the skin, or in too concentrated solutions, which may cauterize. If the agent be used cautiously and according to the rules which serve for the treatment of hyperidrosis in general, with cleanliness and frequent changing of the clothes, it must be followed by good results.[28]

℞ Acid. sulphur. . . . . 3 iss.
Aq. calcis. . . . . Ovi.
M. S. Foot-bath for sweating of the feet. The feet should remain ten minutes in the bath, which is to be repeated every third or fourth day.

℞ Acid. salicyl. . . . . 3 i.
Aquæ [illegible] . . . . . 3 iij.
[illegible] . . . . . ℥ iij.
M. S. [illegible] cum talco (German Pharm.).

℞ [illegible] . . . . . 3 vi.
[illegible] . . . . . ℥ iij.
[illegible] . . . . . 3 ss.
M. S. Dress powder.

℞ [illegible] . . . . . 3 ss.
[illegible] . . . . . ℥ iiiss.
[illegible] . . . . . q. s.
[illegible]
M. S. Powder for local sweating, better than the officinal.

℞ [illegible] . . . . . 3 ij.–3 iij.
[illegible] . . . . . ℥ iiiss.
M. S. To be powdered before going to bed on the feet previously washed and dried, and when necessary repeated after [illegible] days. One should commence with the [illegible].

[illegible] takes a position among the acids similar [illegible] among the alkalies. It produces neither [illegible] nor the irritation which the other acids do. [illegible] may be applied to the skin in any form whatever [illegible] as long a time as necessary, without producing [illegible]. Its action is similar to that of the soaps, [illegible] and it may be used as well in acute hyperæmia as in chronic inflammatory conditions of the skin. It [illegible] with good effect in erythema, in hypersecretion of the sebaceous glands, and in hyperidrosis. The form in which it is to be applied depends here also on the condition of the [illegible] skin. It is not used often enough for cosmetic purposes, probably because it is so insoluble, requiring three [illegible] parts of cold water for its solution.

℞ Acid. borici, ... ʒij.
Aq. rosæ, ... ʒ iiiss.

M. S. For application in erythema, small compresses are to be dipped in the fluid, and left over night on the reddened places.

℞ Acidi borici, ... ʒ iss.
Lanolini,
Ungt. emoll., ... āā ʒ i.

M. ft. ungt. S. For sunburnt skin it is to be spread on cloth and applied.

℞ Acid. borici, ... ʒ iss.
Vaselini,
Empl. diach., ... āā ʒ iij.

M. f. emplast. S. For a similar purpose on skin less sensitive.

Although chemically they do not belong here, we shall speak of some substances containing acidum tannicum, and some allied to acidum salicylicum.

The substances containing tannin, as whose representative we must take tannin itself, acidum tannicum from galls, produce, in a manner not satisfactorily explained, a thickening of the skin similar to that produced in the skin of dead animals by tanning. This thickening is the most important element in the astringent action of tannin on the superficial vessels, although it probably also affects these directly. Hypersecretion is affected in different manners by acidum tannicum. It is used in chronic hyperæmia with relaxation of the tissues of the skin—*e.g.*, in chronic erythematous blotches, in chronic inflammatory chilblains, in seborrhœa and hyperidrosis. It has also been used in teleangiectases and varices, and in superficial excoriations. In the latter case its action depends on the protecting covering formed by the coagulation of the albumin. Its application is somewhat restricted by the fact that the portions of the skin so treated turn dark brown or black under the influence of air and light.

Tannin, and less frequently oak bark and galls, are prescribed in aqueous solution, in alcohol, glycerin, collodion, and in salves and soaps. The latter, sapo tannini, should be

made from one part tannin and nine parts soap, and is recommended as a wash in intertrigo.

℞ Acid. tannici, ... gr. xvi.
Spir. vini rect.,
Glycerini, ... āā ʒ i.
Aq. destil., ... ʒ iss.
M. S. To be used with a sponge in seborrhœa.

℞ Acid. tannici, ... ʒ i.
Sulph. præc., ... ℈ ij.
Pulv. cumil., ... ʒ ij.
M. S. To be rubbed on blotches in the skin.

Phenol and its contained tar, allied to the acidum salicylicum, have as is well known, the property of moderating inflammatory symptoms of the skin and of contracting the vessels of the skin.

β Naphthol, lately introduced, seems analogous in its action. These substances may then be used for the same cosmetic uses as the acidum salicylicum—*i.e.*, in hyperidrosis and in seborrhœa, in a fitting form of application. The odor of acidum carbolicum unfits them for many purposes; for others, such as sweating of the feet, it makes them more useful. Naphthol does not irritate the skin, and is especially good in many cases.

℞ Acid. carbol., ... ʒ iij.
Spir. vini rect.,
Aq. destil., ... ʒ viij.
M. S. For washing the feet.

℞ β Naphtholi, ... ʒ iij.
Spir. vini gall., ... ʒ vi.
Spir. colon., ... ʒ i.
M. S. As a wash in sweating of the soles and palms (Kaposi).

℞ β Naphtholi, ... gr. xvi.
Amyli seu talci veneti, ... ʒ iiiss.
M. S. Powder for sweating of the feet.

Following these are a number of substances frequently used for cosmetic purposes, whose action resembles the action of the foregoing agents on the skin. These are the

Balsams and Resins.

Although cosmetically these are mostly used on account of their pleasing odor, they still have an action of their own. This is due partly to the resinous acids and ethereal oils, and partly to the carburetted hydrogens contained in them. The least active are the resinous acids. The ethereal oils, on the contrary, so far as they do not act as agents improving the odor, have an irritating action on the skin and cause redness, and even, in some cases, dermatitis. Used in a proper dilution they stimulate the skin moderately, and cause an increased circulation of the blood, by which the skin is reddened slightly and made tenser—*i.e.*, its tone is increased.

The action of tar may be taken as a type of that of the hydrocarbons contained in a number of balsams. The action in some cases is one directly opposed to that of the ethereal oils. In many cases of chronic or subcutaneous hyperæmia of the papillary layer, tar acts as a direct astringent to the vessels and destroys them. In a manner similar to tar, acts also the creosote contained in it, which is regarded as an astringent disinfecting agent, which dissolves the superficial layers of the skin.

After tar, come Peru and tolu balsam, fluid storax, benzoin, myrrh, and other resins.

Tar, beech tar (P. liquida), is a thick, oily, black fluid of peculiar odor, obtained by dry distillation of beech wood. In place of this is often used cade-oil (oleum juniperi empyreumaticum), yellowish-brown, of disagreeable odor, and birch tar (oleum rusci), reddish-brown, thinly fluid, and having the odor of Russia leather.

Peru balsam is a thick, reddish-brown or black fluid of pleasant, vanilla-like odor. The semi-fluid, bright yellow tolu balsam has a similar odor.

Benzoin is a fragrant, reddish-gray, resinous mass, in which almond-formed, milky-white resinous bodies are deposited.

Apart from the uses which tar and similar substances find in a great number of severe skin diseases, tar is an excellent remedy for many forms of hyperæmia of the skin, such as chilblains, and for exfoliation of the skin, for seborrhœa, and often for simple itching. It may also be remarked that all the substances of this group are very excellent anti-parasitic reme-

[illegible] may be used for the same purposes [illegible] less inclined to [illegible] is a protection to [illegible] and fissured skin.

[illegible] may be used [illegible] results particu- [illegible]. Tar is here [illegible]. While it is [illegible] there are skins [illegible] its use causes [illegible] parts [illegible] hard, inflammatory [illegible] possibility of the absorp- [illegible] following its use should be

[illegible] and balsams also [illegible] by becoming deposited [illegible] of the sebaceous glands [illegible] and making the skin [illegible] of the resin in the creases is [illegible] concealing the wrinkles, a me- [illegible] taking place. In this man- [illegible] being formerly believed [illegible] the latter evenings after [illegible] would be prevented.

[illegible] seldom used alone, but gen- [illegible] usually combined with [illegible]. A very popular form is that [illegible] made by mixing alco- [illegible] precipitation [illegible] soap-like fluid. [illegible] other milky [illegible] balsam [illegible] water. Such [illegible] for active sub- [illegible] aromatic fluids [illegible], besides the [illegible] very often toilet [illegible] properties of [illegible] this or other [illegible] [illegible]

lait virginal, as said before, may injure the complexion when used for a long time, it is a very innocent toilet water in comparison with these other preparations.

In preparing toilet waters of this sort, which may be done at home, the resin solutions are to be added gradually to the water and shaken continually.

℞ Tinct. benzoini, ... ʒ iiss.
Aq. rosæ, ... ℥ iiiss.
M. S. Lait virginal.

℞ Tinct. bals. tolut., ... ʒ ss.
Aq. rosæ, ... ℥ vi.
M. S. Lait virginal à la rose.

℞ Tinct. benzoini, ... ʒ ij.
Aq. flor. sambuci, ... ℥ viij.
M. S. Extrait de fleurs de sureau (Piesse).

℞ Træ. benzoini, ... ʒ i.
Potas. carbon.,
Spir. camphor., ... āā gr. xvi.
Aq. coloniens., ... ℥ viiss.
Tinct. ambr. mosch., ... ♏ iv.
M. S. Eau de princesse.

In a similar manner, lait virginal is to be prescribed together with some other distilled water, such as aq. naphæ. In order not to do harm, it is so prescribed that one or two spoonfuls may be put into the wash water. Exceptionally, when active substances have been dissolved in the milk, it may be pencilled on or used as an application, like the eau de princesse just given. The following mixture may be pencilled on chilblains:

℞ Bals. Peruviani, ... ʒ i.
Mixt. oleosobalsam.,
Aq. coloniens., ... āā ℥ i.
M. S. For external application (Rust).

This agent may also be combined with soap, as for example:

℞ Sebi bovini,
Picis nigr.,
Liq. sod. caust., ... āā ʒ vi.
Calefac, coque ad spissit. Sapon. pond., . . ℥ iss.
M. S. Tar soap (Auspitz).

℞ Sebi bovini,
Ol. cocois, ... āā ʒ iiiss.
Liq. potass. caust. sp. gr. 1.45, . . . ʒ vi.
Calefac f. sapo cui adde
Pulv. lapid. pumicis, ... ʒ iiiss.
Creosoti puri, ... ♍ij.
Ol. cinnamomi, ... gr. xvi.
Ol. citri, ... ʒ ss.
F. frust. pond., ... ℥ ij.
S. Creosote soap (Auspitz).

This creosote soap is at the same time a pumice-stone soap, and may be prescribed as such without the creosote. A benzoin soap has already been mentioned. In the application of this, the action of the soap should not be lost sight of, and with the tar soap, the possibility of the unfavorable action of the tar. Many of these substances may also be prescribed in the form of pastes or powders and be used as washing agents.

℞ Amygd. dulc., ... ℥ i.
" amar., ... ʒ iiss.
Bals. peruviani,
Mellis albi, ... āā ʒ i.
M. ft. pasta. S. A piece as large as a hazel-nut should be rubbed with water in the hand and then on the face and hands. For removing wrinkles.

℞ Benzoini, ... ʒ vi.
Saponis domestici, ... ℥ ij.
Sodii boras,
Sodii carb., ... āā ʒ iiss.
Rhiz. iridis flor.,
Talci veneti, ... āā ℥ ij.
Ol. bergam., ... ♍ij.
M. f. pulv. subtilis. S. To be used in the wash water in cases of comedones (Hager). The sodii boras and the sodii carb. are here the active ingredients.

Ichthyol should be mentioned here. This is a fluid oil obtained by the dry distillation of a bituminous mineral of Tyrol, or in a narrower sense the salts of the sulphichthyolic acid contained in the oil. Formerly ammoniæ hydrochloras was improperly called ichthyol. This is a repulsive smelling and appearing substance which probably has the action described by Unna, and on this account is not adapted for cosmetic purposes. Ichthyol is but seldom employed with us. The following mixture might theoretically be prescribed for pigmentation of the skin:

℞ Ammon. sulfoichthyol.,
Bol. rubr.,
Træ. curcumæ, ... q. s.
Ut f. pasta.

This paste is meant to exclude the chemical effect of the light. Since, as said before, the ephelides are at least not entirely due to the action of the sun, this paste will not have a more marked effect than sulphur-tar pastes, which are often of value in cases of pigmentation, and to which the ichthyol is allied.

Agents Irritating the Skin.

The agents coming in this category act mostly by producing first a hyperæmia of the skin, then, if continued, a dermatitis, and finally a deep ulcer. Many of these are used in therapy merely as skin irritants. If the action stops at the hyperæmia, as with veratrine, and with the cosmetic agent tinctura veratri albi, there is no objection to the application of these, since, apart from the general action, which can easily be prevented, there are no bad effects to be feared. For this reason the results obtainable are very slight, for since these agents affect only the sensory nerves of the skin and the superficial vessels in a transitory manner, the removal of pigment spots, for example, is impossible.

It is otherwise with the application of such substances as may cause dermatitis and the formation of vesicles. In this case the skin is destroyed down to the corium, and the pigment masses collected there are also destroyed. Agents like cantharides, mezereum, croton oil, and mustard oil, might be used for destroying new growths and pigment spots, if it were not known that after this destruction great collections of pig-

ment form in the new rete Malpighi. We have seen before that this new formation of pigment caused these agents to be used when there was a lack of pigment in the skin, as in small circumscribed vitiligo spots; yet this employment has the disadvantage that the new-formed pigment varies both in quantity and kind from the normal. This is least the case with mustard oil, which, because it has a transitory reddening effect on the skin that is not injurious when small quantities are used, is often employed to redden the face and hands. For this purpose a solution of ethereal mustard oil 1:250 in water or dilute alcohol is sufficient. For the removal of freckles stronger solutions must be used.

℞ Spir. sinapis,
Aq. coloniensis, ... āā ℥i.
Aq. rosæ, ... ℥iiiss.
M. S. To be painted on the freckles.

℞ Sodii bor. pulv., ... ʒi.
Acid. salicyl., ... ʒss.
Aq. ros.,
Aq. flor. aur., ... āā ℥iiss.
Liqu., filtr., admisce
Tinct. benzoini,
Bals. vitæ Hoffm.,
Spir. sinapis,. . . . . āā ʒi.
M. S. Shake. Parisian water for freckles (Hager).

In this mixture the sodii boras and the acidum salicylicum are the chief active substances. Mixtures of mezereum and croton oil might be used, but are not to be recommended. Cantharides is also unadapted for this purpose. Since the last-named agent may cause a more or less deep destruction of the skin, it can be employed for the removal of warts, corns, etc.

℞ Empl. plumbi comp., ... ℥iss.
Empl. galbani, ... ʒiij.
Picis naval., ... ℥i.
Ammon. muriat. subt. pulv.,
Æruginis subt. pulv., . . . āā gr. xxv.
Cantharidum, ... gr. xvi.
M. ft. empl. S. Corn plaster (Hager).

Iodine Preparations.

In its action on the skin, iodine resembles the last-named agent. If iodine be applied to the skin, immediately if the solution be concentrated, after a time if it be dilute, the skin takes on a yellow or dark brown color, which may be removed by the alkalies while it is still fresh, but which, if not disturbed, continues until the superficial layers of the epidermis are cast off. If iodine be used in substance and its evaporation be prevented, there is produced a dermatitis with the formation of vesicles and a pricking, burning pain. This pain and the dermatitis frequently do not come on after a single application of dilute iodine solution; but after repeated pencillings a more or less severe pain comes on, and a great vesicle is formed over the whole extent of the surface pencilled. If the application be now suspended, the elevated superficial skin, with the exudate, dries to a parchment-like elastic sheet, beneath which the delicate new-formed epidermis presents itself. If the application be continued after the formation of the vesicle, the dermatitis may increase and, extending into the corium, cause a very painful, slow destruction of the skin. Iodine then, in small quantities, diluted, and used for a short time, acts as a slightly irritating agent to the skin, which may relieve a superficial hyperæmia in a relaxed and loosened skin; in larger quantities, applied more concentrated or for a longer time, it acts as a destructive agent on the superficial layers of the skin. For our purposes, the action of iodine and its preparations in hastening absorption is of no importance. As a gently stimulating and detergent agent, iodine may be used in cases of chilblains which show dilated vessels in a relaxed, scaly and bluish-red skin.

℞ Træ. iodi,
" gallar., ... āā ʒ iiiss.
M. S. To be pencilled on chilblains.

℞ Iodi, ... ʒ i.
Collodii, ... ℥ iiiss.
M. S. Iodine collodion. To be used like the preceding.

℞ Tinct. iodi, ... ʒ iij.
Liq. sodii chlor., ... ℥ i.
M. S. Like the preceding.

℞ Iodi, ... 3 ss.
Glycerini, ... ℥ iiiss.
M. S. Like the foregoing.

For this purpose a combination of iodine and tannin may be used, or a tinctura iodi decolorized by sodii hyposulphis. In this tinctura iodi decolorata, it is no longer the iodine, but the hydrate of iodine, which is the active agent, but this has the same effect on the skin as the former. Cotton wool dipped in liquor iodi compositus may also be applied to chilblains. The deeper action of iodine makes it useful for the destruction of pigment. For the removal of freckles either the tincture or a concentrated solution may be applied until a vesicle is formed, the surrounding skin being protected. The freckles disappear with the casting off of the old epidermis.

℞ Iodinii,
Potas. iodati, ... āā 3 i.
Glycerin., ... 3 ij.
M. S. To be pencilled on the skin (Kaposi).

This treatment is also of advantage in acne which has arisen from comedones. A delicate, sensitive skin contra-indicates the use of iodine. It is further to be looked to that after the energetic application of iodine dark diffuse pigment spots do not remain.

Sulphur and its Preparations.

Sulphur is one of the most important agents in the therapy of skin diseases, and especially in cosmetics. Very little, however, is known of its action; this is only to be learned by its effects. If powdered sulphur be brought in substance into contact with the skin, it produces no effect; if it be energetically rubbed in, alkaline sulphites are formed and it acts like these. That such a process must occur is shown by the fact that after rubbing in pure sulphur salve, the odor of hydrogen sulphide is perceived. The fact that the sulphur has a more intense effect on the skin when it is applied combined with alkalies, also speaks for the action of the sulphur as an alkaline sulphide. In the other manners of its application in which the sulphur is mixed with alcoholic or acid fluids, these form

merely the vehicle, and its action in these mixtures depends on the manner and the period of its application. While the alkaline sulphides formed have in general an action on the epidermis similar to that of the caustic alkalies, since they swell and dissolve the horny substance, this is not exactly the case with the alkaline sulphides, which are first formed on the skin. These act much more mildly, although they have a certain action in contracting the vessels of the skin. Because of this action, sulphur is used in all those cases in which it is wished to destroy the epidermis to a certain depth; further, in abnormal exfoliation of the epidermis, in seborrhœa, and in certain affections of the skin which are associated with dilatation of the capillaries and increased vascularity. If a more intense action be desired, either alkaline sulphides or a mixture of sulphur with alkalies would be used; if a milder action be wished, the application of sulphur alone is often sufficient.

For this purpose pure sulphur is used in the form of milk of sulphur, a fine, yellowish amorphous powder, which is obtained by precipitating a solution of calcii sulphis with acids. In place of this, when a more extensive action is desired, calcii sulphidum or sodii hydrosulphydras is used. The latter is used in the form of a solution. Pure sulphur is used either shaken in alcohol, or made into a paste with acids, or mixed with alkaline fluids.

The manner of its application is as follows: Solutions of alkaline sulphides are used as applications, and where a more intense action is desired, rubbed in with a stiff brush. Sulphur pastes are rubbed into the skin or spread on cloths and applied. Mixtures which contain only sulphur as an active agent are applied directly to the skin after being shaken; those which contain also soaps or alkalies are either applied in the same manner or only so that the precipitate from the fluid is applied to the skin. The sulphur should be left some time on the skin, and the following day, perhaps, wiped off with a cloth. If alkaline sulphides or sulphur in conjunction with alkalies are used, there is generally a slight inflammation or a hyperæmia of the skin produced, which must be treated with indifferent salves, powders, and the like. It goes without saying that when sulphur is used, metallic sbustances are not to be employed on the skin at the same time, or dark-colored sulphur combinations will be formed.

As examples of the methods of prescribing sulphur, the following may serve:

℞ Sulphuris loti, ... ℥ ss.
Ol. amygd. dulc., ... ʒ iij.
Axung. benzoini, ... ℥ i.
M. S. Sulphur pomade (Dorvault[29]).

℞ Sulphuris sublimati, ... ʒ ss.
Glycerini, ... ʒ iij.
Spir. camph., ... ʒ i.
" lavand.,
Aq. coloniens., ... āā ʒ iij.
Aq. destil., ... ℥ iv.
M. S. Shake and pencil on the skin or add to the wash water (Hager).

There are a great number of prescriptions for this justly popular remedy; those already given contain but little sulphur. The following are more adapted for an energetic treatment, because of the greater amount of sulphur contained and on account of the addition of lime:

℞ Sulphur. præcip., ... ʒ iiiss.
Camphor., ... gr. xvi.
Mucil. g. arab., ... ʒ iss.
Subige, admisce
Aq. calcis,
Aq. rosæ, ... ℥ iiiss.
M. S. Like the foregoing.[30]

℞ Sulphur. præcip.,
Glycerini,
Spir. vini dil.,
Potas. carb.,
Ætheris, ... āā ʒ iij.
M. S. Cosmetic cream (Hebra).

The thick mixture after being shaken is to be applied with a brush in the evening and washed off with water or a solution of sodii boras in the morning.

This mixture is to be recommended for comedones, especially when the skin is very fatty, and also in seborrhœa of the face.

℞ Sulph. præcip.,
Glycerini,
Spir. sapon. kalini,. . . . . āā ʒ iij.
M. S. As above (Hebra).

℞ Sulph. præcip., ... ʒ i.
Acid. acet., ... q. s.
Ut f. pasta mollis.
M. S. Sulphur paste; to be used evenings on pigment spots, ephelides, and chloasmata (Neumann).

Sulphur may also be given in the form of sulphur soap, but it should be remembered that here its action is most intense in consequence of the alkalinity of the soap. Sulphur may be either added to a manufactured cocoa soap or be added in the process of manufacture; if a more intense action be desired, the sulphur is to be replaced by calcii sulphidum; and if a mechanical action be desired also, sand or pumice-stone may be added, or the sulphur may be combined with other agents, such as iodine or naphthol.

℞ Sapon. cocoini rec., ... ʒ iiiss.
Ol. citronellæ, ... gr. xvi.
Sulphur. depur.,. . . . . ʒ iij.
M. f. frust. pond., ... ʒ iiiss.
S. Sulphur soap.

℞ Ol. cocos,
Sebi bovini,
Liq. sodii caust., ... āā ʒ iss.
Hepat. sulph. lixiv. in aqua tep. soluti, . ʒ ij.
F. via frigida sapo.
Ol. anisi,
Ol. rosmarini, ... āā ʒ i.
M. f. frust. pond., ... ʒ iiiss.
S. Sulphur soap (Auspitz); to be rubbed in with water, evenings, the lather left on overnight and washed off in the morning. For ephelides.

The simple washing with sulphur soap has scarcely any other effect than washing with any other soap; if the action of the sulphur be desired, the soap must be rubbed with water into the skin, and the lather left on overnight. The following day it is to be washed off with water or with almond bran,

and the red macerated skin is to be treated with various agents, such as the solution of sodii boras in seborrhœa, unguentum zinci and powder in acne. Much more intense in their action than mixtures of sulphur with alkalies and soaps are the alkaline sulphides, in using which the odor of hydrogen sulphide is to be expected. Calcii sulphis (solutio Vlemingkx) acts as a caustic on the skin and, like sodii sulphydras (1 : 10 water), is only to be used on the back.

℞ Sodii bor. pulv., ... ʒ i.
Glycerini, ... ℥ ss.
Sodii sulphid., ... ʒ iij.
Aq. ros., ... ℥ xvi.
M. S. To be used as a wash for blotches on the skin.

Metallic Salts.

The metallic salts which have a cosmetic use are salts of aluminium, lead, zinc, bismuth, and mercury. The physiological action of all these, excepting the soluble salts of mercury, is that of the astringent agents in general. Local superficial inflammations and hyperæmia of the skin are cured by these; they contract the capillary vessels which are passively dilated by acne, perniones, etc. By contracting the vessels of the skin they lessen the secretion of the glands, and principally of the sweat glands. Some of these agents when used long or in large doses, even when they are insoluble in water, by their continuous irritation cause more or less inflammation of the skin, and may be followed by an increased exfoliation of the epidermis, or a casting off of this down to the pigmentary layer. A number of these agents, when used in the form of powders and salves, may have a drying effect, while others, because of their intense white color, may serve as concealing agents.

The salts of aluminium and lead belong to the class of light astringents. Of the former, the well-known alum and the aluminii acetas are used in solution for chilblains, redness of the face and hands, and local hyperidrosis. For this purpose the solutions are used as a wash, or in continued applications. Since the alum and especially the aluminii acetas

lessen the secretion of sweat, they are adapted for the cases with offensive odor, and the former is used in the form of powders, the latter in solution, for bromidrosis. For this purpose, aluminii chloras, also called chloralum, is much used. The deodorizing action of the latter is due in great measure to the chlorine set free. Used in the form of white clay for a protecting application, the astringent properties of aluminium do not come into action.

The soluble lead salts, especially plumbi acetas, may be used in the same manner as the salts of aluminium. They also have an astringent action, cure hyperæmia of the skin, and lessen the secretion of sweat. Many preparations of lead serve as drying and slowly acting caustic agents for the removal of thickened and calloused skin, especially with ingrown nails, where the dusting on of plumbi subnitras is of service. Other preparations of lead such as white lead, plumbi hydrocarbonas, are used as protecting agents to the skin, and they are also used in powders for the same purpose as the solutions. Unguentum plumbi subcarbonatis and emplastrum plumbi subcarbonatis are useful in erythematous chilblains. An unusually important preparation of lead which is adapted for use in most of the cases considered here is the unguentum diachylon (Hebra), which may be used not only in the various forms of eczema, but also in hyperidrosis, and in acne, as a mildly acting grease for the softening of indurated portions of the skin in general, and for the removal of crusts and scales. Besides the plumbi acetas and the plumbi subcarbonas, other preparations are occasionally used, as, for example, plumbi nitras 1, glycerinum 40, three times a day on chapped hands. While the lead salts have the astringent action of the metallic salts, they are seldom used, even externally, on account of the possibility of a toxic effect being produced.

Next to these in their action stand the combinations of zinc. The soluble salts, such as zinci sulphas, zinci acetas, and zinci sulphocarbonas, are used in solution as applications for chilblains, pigmentation of the skin, freckles, and chloasmata. They may also be used as local or general baths in hyperidrosis. Even the insoluble zinci oxidum, when applied for a long time to the skin, has an astringent and drying action. In a powdered form it is very often added to dusting powders,

and in the form of Wilson's salve is an excellent and well-known agent for the skin.

Among the bismuth preparations, bismuthi subnitras has but a feeble action on the skin. Although a small quantity of the salt may become dissolved in the secretion of the skin, its action is chiefly mechanical, and, from its white color, concealing. The fact that after energetic application of bismuth salves a slight dermatitis may ensue, would seem to indicate a chemical action of this agent, though perhaps very slight. The basic bismuthi nitras is used for the removal of freckles and other forms of pigmentation of the skin, and combined with white precipitate in the form of a salve, it is a justly popular face pomade for beautifying the complexion. The action of this latter depends no doubt on the fact that the superficial layers of the epidermis are more readily cast off under its employment.

Of the mercurial preparations only two have an extensive cosmetic use, the hydrargyri chloridum and the hydrargyri bichloridum ammoniatum. Sublimate, which is soluble in water, alcohol, and ether, when applied to the skin in concentrated solution acts as a caustic and may cause a severe purulent inflammation of the skin. When a very dilute solution is applied for a long time, it causes a dermatitis also, but this remains superficial, although under its use the epidermis is raised in vesicles filled with serum. It cannot be said that the sublimate hastens the exfoliation of the epidermis scales, but it always causes a more or less severe inflammation of the skin, which leads at least to the detachment of the superficial layers of the epidermis. Because of this action, sublimate has but a limited sphere of application. It may be used either as a caustic agent for warts, etc., or as a washing agent in different varieties of pigmentation of the skin. Its use for the removal of freckles has already been described. On account of its exact action on the skin, sublimate has unfortunately received great attention from the vendors of beautifying agents, and it is sold as a panacea for all possible disfigurements, such as acne, comedones, erythema, and any efflorescence of the skin. This is the more to be deprecated since these readily soluble preparations of hydrargyrum may be absorbed by the skin and cause poisoning, and this may also follow the careless use of hydrargyrum in other cases.

Sublimate and other preparations of hydrargyrum should only be used for cosmetic purposes under a physician's prescription.

The white precipitate, hydrargyrum bichloridum ammoniatum, has in reality the same action as the sublimate, it is, however, much slower and milder; when energeticlly applied to the skin, it is dissolved by the sweat. The action of this preparation is threefold. First, it produces a superficial dermatitis; second, it has a mechanical action on account of its powder form; and, third, it serves as a concealing agent because of its white color. The white precipitate is employed in all those cases in which sublimate is used, when a slower and a milder action is desired, as in pigmentation of the skin, obstinate acne, etc. For the same purpose as the others, we may employ with similar results other salts of hydrargyrum, such as hydrargyri oxidum rubrum, oxidum nigrum, acetas, and the submurias. The latter has none other than a mechanical and concealing action.

The gray plaster should be mentioned as a very important agent, which in the diseases that we are considering has no mercurial action, but merely that of the plasters, in shutting off the air and preventing the evaporation of the moisture of the skin, so that the epidermis becomes swollen and is more easily thrown off. With this intention, emplastum hydrargyri may be used on callosities and corns, and for induration or pigmentation of the skin.

℞ Zinci sulph.,
Acid. tannici, ... āā ʒ ss.
Aq. rosæ, ... ʒ iij.
Ungt. emoll., ... ℥ i.

M. ft. ung. S. Salve to be rubbed on erythematous blotches on the face and on chilblains, to be left on over night and dusted with zinc powder in the morning.

℞ Benzoin. pulv., ... gr. xvi.
Axung. porci, ... ℥ i.
Digere, cola, adde
Zinci oxid., ... ʒ i.

M. ft. ung. S. Wilson's salve.

℞ Zinci sulphocarbol., ... ʒ ss.
Glycerini, ... ʒ vi.
Aq. rosæ, ... ℥ i.
Spir. colon., ... ʒ i.

M. S. Water for freckles. To be painted on in the evening and let dry; to be washed off in the morning with borax water.

℞ Boli alb.,
Ol. lini, ... ää ℥ i.
M. exact., adde
Zinci oxid.,
Liq. plumb. subacet., ... ää ʒ vi.
Ol. neroli, ... q. s.
Ad odorat.

M. ft. pasta. S. To be painted thickly on the affected skin; to be rubbed off with zinc powder in the morning.

℞ Tutiæ, ... ʒ ij.
Ungt. rosæ, ... ℥ ss.
Butyri c. aq. ros. loti, ... ℥ ss.

M. ft. ungt. S. Pommade de Tuthie (French Pharm., Dorvault).

℞ Ol. amygd. dulc., ... ℥ ij.
Spermaceti, ... ʒ i.
Ceræ alb., ... ʒ ij.
Liquef. admisce
Zinci sulph., ... gr. xvi.
in Aq. rosæ, ... ʒ iij.
Soluti.

M. exact. f. ungt. S. For cracked hands and nipples (Débay).

℞ Alumin. cr., ... ʒ i.
Aq. dest., ... ℥ iiiss.

M. S. Application for chilblains and red nose.

℞ Alumin.,
Sodii bor., ... āā ʒ ss.
Aq. rosæ, ... ℥ v.
Tinct. benzoini, ... ʒ i.

M. S. Like the foregoing.

℞ Alumin. cr., ... ʒ ss.
Acet. arom., ... ℥ iiiss.
M. S. Like the foregoing.

℞ Sodii bor., ... ℥ ss.
Alumin., ... ʒ iij.
Acid. tan., ... ʒ iij.
Amyli, ... ℥ ij.
Ol. æth. cort. aur., ... gtt. xxv.
M. S. Sweat powder, also recommended for beginning chilblains.

℞ Alumin. acetico-tartar., ... ℥ ij.
Aq. destill., ... ℥ iv.
M. S. To be painted undiluted on chilblains; three to four tablespoonfuls to be added to cool foot-bath for sweating of the feet.

℞ Alumin., ... ʒ i.
Vitell. ovi cocti unius,
Glycerini, ... ʒ ss.
M. ft. ungt. S. For chilblains (Husemann).

℞ Alumin. usti, ... ʒ iij.
Magnes. carb.,
Pulv. irid. florent., ... āā ℥ iiiss.
Pulv. caryophyll., ... gr. xvi.
M. S. For filling muslin sachets to be worn in the axillæ in excessive sweating (Débay).

℞ Liq. alumin. acet. (Burowi), . . . ℥ i.
Aq. destil., ... ℥ viij.
M. S. For applications and as a wash in hyperidrosis.

℞ Bismuth. subnitr., ... ʒ i.
Zinci oxid., ... ʒ i.
Ungt. emoll., ... ℥ iss.
Ol. naphæ, ... gtt. v.
M. ft. ung. S. Salve for sunburned face and hands.

℞ Bismuth. subnitr., ... gr. xvi.
Tinct. benzoini, ... ʒ i.
Glycerini, ... ʒ vi.
Aq. fragor., ... ℥ iiiss.
M. S. After shaking to be used for scaly skin.

℞ Bismuth. carbon. basici, ... ℥ iij.
Talci veneti, ... ℥ vi.
Aq. rosæ, ... ℥ iiss.
Spir. colon., ... ℈ ij.
M. S. As before; if it is used as a cosmetic the moist precipitate is to be pencilled on.

℞ Hydrarg. bichlor. corr., ... gr. i.
Aq. ceras., ... ℥ xx.
Spir. vini rect., ... ℥ i.
Plumbi acet., ... ℥ ss.
Tinct. benzoini, ... gtt. xxx.
M. S. Eau de Gerlain; for painting on blotches.

℞ Hydrarg. bichl. corr., ... gr. i.
Emuls. amygd. amar., ... ℥ xij.
Tinct. benzoini, ... ℥ ss.
M. S. Aqua orientalis (Hebra). To be used as a wash in red, scaly, but not inflamed skin.

℞ Hydrarg. bichlor. corr., . . . gr. xvi.–℥ i.
Aq. naphæ,
Spir. vini rect., ... āā ℥ iss.
M. S. To be used with care as above, for the quick removal of ephelides.

℞ Hydrarg. bichlor. corr., ... ℥ ss.
Collodii elastici, ... ℥ vi.
M. S. For destroying warts and corns.

As the collodion covering presses the vesicle and causes pain, it may be replaced by ether. In the latter case, as in the employment of sublimate in general, care must be taken that the agent does not get into the mouth.

℞ Aq. colon., ... ℥ i.
Spir. ammon. comp., ... ℥ ss.
Potas. iod., ... gr. xxiv.
Sodii carb., ... ℥ iiss.
Hydrarg. iod. rub., ... gr. x.
Aq. camphor., ... ad ℥ ivss.
M. S. As a wash for blotches.

℞ Liq. hydrarg. nitr. oxid. (19% Germ. Pharm.), ... gr. xvi.
Aq. rosæ, ... ʒ vij.
M. S. Water for freckles (Hager). Single ephelides or chloasmata to be touched every second or third day.

℞ Hydrarg. præc. alb.,
Bismuth. subnitr., ... āā ʒ i.
Ungt. glycerini, ... ʒ iv.
M. S. Salve for freckles (Hebra). To be rubbed in energetically for two or three consecutive days; then to be stopped.

The reaction following the use of this mixture is considerable; the skin reddens and scales off in large patches. In the intervals, applications of a solution of sodii boras or of Goulard's water are to be made, or the part anointed with a bland salve.

Milder and correspondingly slower in action is the following face pomade:

℞ Hydrarg. præc. alb.,
Bismuth. subnitr., ... gr. xvi.–ʒ ss.
Ungt. pomadinum, ... ℥ ij.
M. S. Pomade which may be rubbed in every day for a time, and is of service in sunburn. Calomel may be used in the same manner as the white precipitate (Oppolzer).

℞ Hydrarg. chlor. mitis, ... gr. xvi.
Bismuth. subnitr., ... ʒ i.
Aq. fragor., ... ℥ iss.
M. S. After shaking, to be used on liver spots and erythematous portions of the skin.

Of the metallic salts should also be mentioned acidum arseniosum, which possesses the property, valuable from a cosmetic point of view, of cauterizing abnormal portions of the skin, such as hypertrophy and granulations, without affecting the sound portions. In the form of pulvis cosmi or of Hebra's arsenic salve it is extensively used in lupus. According to Unna, the acidum arseniosum is a useful agent for the removal of warts, and is most applicable in the form of a plaster of the ordinary variety, or of gray plaster.

℞ Empl. hydrarg. cin., ... 3 iij.
Acid. arsen., ... gr. iij.–viij.
M. ft. emplastrum. S. Plaster.

℞ Oleini crudi, ... 3 iij.
Plumbi oxid., ... 3 ss.
Ft. empl. adde
Arsen. albi., ... gr. xvi.
S. Plaster (Lang).

Powders and Cosmetics.

The numerous agents of this group are employed for two different purposes, either as protecting and moisture-absorbing agents or as concealing and coloring agents. For the former, vegetable substances are chiefly used; for the latter, mineral substances.

Starch and other Vegetable Powders.—When the fine skin of the face and hands is exposed to the atmosphere after being washed with soap or with simple water, even when thoroughly dried, it becomes rough and fissured. Persons endeavor to combat this by using all sorts of creams and powders on the skin. The powdering of the face after shaving is for the purpose of protecting from the influence of the air the skin which has been irritated by the soap, the razor, and the washing. The powders of this group are here serviceable.

Starch is to be considered the most important representative of these. Pure starch finely powdered and applied to the skin makes it smooth and cool, lessens the irritation and pain of sensitive superficially excoriated spots, and protects them from the influence of too high or too low temperatures, and from the rubbing of neighboring portions of the skin. All fine powders, and especially the vegetable ones, absorb fluids which have been poured on the skin. Mixed with these fluids or the sweat, starch forms a thick, tenacious paste, which becomes detached in the form of blackish masses. At the same time a chemical change occurs and the paste becomes sour from the formation of acidum lacticum.

Other vegetable, indifferent or fragrant, powders are added in considerable quantities to starch, to form face powders. What was said of starch applies also to these. Mixed with the sweat, they decompose, forming products of acid reaction

and odor, and since their woody parts swell in the fluid of the sweat, they cause what they should prevent, the maceration of contiguous portions of the skin. The swollen and adhering masses of such powders, and of starch as well, irritate the skin on which they lie like a foreign body, and by the pressure which they exert, favor the formation of callosities and corns. I have seen from the employment of orris powder, used as a perfume in powders for sweating of the feet, enormous loosening of the epidermis between the toes, with great pain, and even erosions and ulcerations. The use of orris powder should be condemned on this account, although for other purposes it is harmless. It is added to washing powders, in order to make them finer and more pleasing in appearance and in odor. On account of their containing albumin and starch, these powders are mild and cleansing like the almond powder, while many of them are excellent since they contain a little fat. In the form of soft pastes they have, like the fatty agents, a soothing and cleansing action.

The most important of these is rice starch, amylum oryzæ, poudre de riz. It is a fine, smooth-feeling powder of pure white color, lighter than water, and mixed with this it forms, like the other starches, a sticky mass or paste.

But very little of the powder which is sold as rice starch is in reality such. It is adulterated with other starches, or mixed with talc, chalk, etc., to make it whiter and more concealing, as will be shown later in treating of cosmetics. Rice powder is but seldom used; in place of it other powders are employed, although a moderate amount of rice powder forms an excellent protecting agent. When society ladies appear to-day with bare necks and arms, these parts are not encompassed in a cloud of powder, but covered with a heavy coat.

Wheat starch, amylum tritici, may be used in place of rice powder. It is a very fine, smooth, bluish-white powder. This bluish-white color is not suited for all complexions.

Potato starch, amylum solani, is a coarse yellowish-white powder, shining in the light, which cannot well be used pure for cosmetic purposes.

Wheat powder is occasionally used in place of starch in the composition of washing powders and pastes prepared extempore. The powder for this purpose must be pure, white, and of good quality. The powder of vegetables such as beans

may be used in face powders, washing powders, and pastes in the same manner as wheat starch. Wheat bran, which contains fat, and the powder of marsh-mallow root, which is mucilaginous and softens the skin, may be used in washing powders and pastes. Instead of a paste made of meal or bran, the popular poultices of white bread and milk may be used, which, like the bean meal, have long been used by the laity.

". . . multo
Pane tumet facies,"

says Juvenal. Orris-root powder is used only for perfuming. The following will serve as examples:

℞ Amyl. oryzæ, ... ℥ iiiss.
Pulv. ir. fl., ... ℥ i.
Ol. geranii, ... gtt. v.
M. S. Rice powder.

℞ Farin. legum. (fabar.),
" oryzæ, ... āā ℥ iiiss.
" amygd. am., ... ℥ vij.
Ol. æth. lavandul., ... ℈ij.
M. S. Washing powder for the hands.

℞ Farin. trit.,
Pulv. melilot., ... āā ℥ viij.
Pulv. violar., ... ℥ iiss.
M. S. To be mixed with rose water into a paste, with which the face is to be covered for the night. "This paste lends the skin a freshness, and removes red blotches and pimples" (Débay).

℞ Pulv. althææ subt.,
Farin. amygd. am., ... āā ℥ iiiss.
Essent. portug.,
" bergam., ... āā gr. xvi.
M. S. Face paste.

Cosmetics (concealing and coloring agents).—If the skin of the visible portions of the body be completely clean, if it have neither red nor other colored blotches, if it be neither too oily nor too dry, it is to be considered normal. It may be white, or red, or yellow, providing that the color be not too

intense, and still satisfy the average man. But this does not satisfy artistic taste or fashion. Artificial lighting, the intense yellow and yellowish-red light of hundreds of gas flames or incandescent lamps, the glaring white or bluish-white light of the arc lamps, make the normal skin appear of tints which are by no means pleasing. Time and pleasure as well as grief and sorrow not only engrave deep wrinkles in the face and neck, but destroy the color of youth and cause the skin to wilt like a flower deprived of water. Fashion, the ruler of all times and peoples, demands to-day a blooming, youthful countenance with rosy cheeks, to-morrow a pale, sentimental, spirituelle, almost sickly beauty—the morbidezza.

The desire to be conspicuous causes a woman to choose to-day the complexion of a robust peasant, to-morrow the bronze color of an Ethiopian, and another time the sallow yellow of the southern races.

For this purpose cosmetics are used, which have the function of giving to the exposed parts of the body another color than that which hature has provided, generally a more youthful one; occasionally, as with actresses, they serve for changing the expression of the face, and for concealing defects of every sort. Since it is the purpose of the cosmetic to deceive the beholder, the first requirement of such an agent is that this deception be the most complete possible—*i.e.*, that the color be the most natural possible, a requirement which is fulfilled not only by the selection of a proper agent, but much more by the skill of its application. Even when the most innocent materials are used in the preparation of these paints, they are the most injurious of cosmetics.

The simplest cosmetic agent is the white powder called by the collective name poudre de riz, which, as before stated, seldom consists of rice powder, but oftener contains talc or even chalk. On account of its finely-powdered form it absorbs the moisture of the skin and is called, therefore, an absorbent powder. Even these cosmetics, which when occasionally used are harmless, when continually used may injure the skin so severely as to preclude the possibility of its restoration. The complexion loses its natural gloss and freshness; the skin appears dry and rough; the orifices of the sebaceous and sweat glands are clogged by the cosmetics which have taken up the atmospheric dirt; countless comedones are formed, and in time

[illegible] become portable which can no longer be concealed by [illegible] and more dangerous agents are employed for this purpose. The moister and more oily the skin, and it is individuals with such skins who in their ignorance use absorbing powders—the more harmful is their action.

If the cosmetics are made from metallic salts, the changes which the skin suffers are still more considerable. The salts are soluble in a measure at least in the sweat, and by contact the [illegible] become active in themselves, become [illegible] agents. To the symptoms described may be added the wrinkling of the skin and an extreme sensitiveness to atmospheric influences. Wrinkles, usually a symptom of age, appear in the skin, and those already existing become deeper; the skin becomes stiff and inelastic, and the muscles in the face lose their mobility; the expression of the [illegible] and dark. The dazzling white [illegible] to their cosmetics is in reality [illegible] that when energetically rubbed in [illegible] by the unbroken skin from these [illegible] the chronic poisonings, with nervous symptoms [illegible] by the cosmetic use of this metal, have been [illegible] enough. This poisoning is not caused [illegible] the skin alone, but from the presence [illegible] the mouth and stomach.

[illegible] the danger incurred, cosmetics, and especially [illegible] are always to be found on the toilet-tables of [illegible] girls, and the habit of using powder is [illegible] early childhood. Used in the beginning only [illegible] absorbing moisture, as a simple rice powder, [illegible] indispensable as a cosmetic, a beautifying [illegible] with various substances, as in the poudre de [illegible] It is, however, not to be wondered at that the [illegible] of our time are not more rigorous than their ancestors [illegible] agent, as well as many others, having been [illegible] thousands of years ago by the ancient Egyptians.

The colors of these paints vary according to the purpose [illegible] they are to be used; they are white, red, blue, and [illegible] colors. They are further divided, as to form, into [illegible] paints—i.e., salves and cerates—and fluid [illegible] The most simple classification is according to their [illegible]

1. White cosmetics. Talc, calcii carbonas and sulphas, and magnesii carbonas, serve as a base for face powders and white cosmetics. The two first mentioned are those most frequently used; in fact, talc may be said to be the general base of all the cosmetics.

Talc, magnesii silicas, is an oily-feeling, white, crystalline mineral, which is prepared in various ways for different purposes.

It is finely powdered, cleaned by pressing through a fine cloth and washed, then dried and ground up; or the powder is macerated with vinegar, then washed with water and dried. Talc powder prepared in this way has a gloss; to prevent this it is heated (calcined talc). In the same manner as the talc well-cleaned lapis baptistæ or alumen plumosum may be used. The finest talc is called Venetian chalk. Craie de Briaçon, or Spanish chalk, is the same. The fine purified and cleansed talc is called blanc français, French white.

Chalk, calcii carbonas, the well-known white earthy mineral, is prepared in the same manner (creta elutriata); the natural chalk produces a powder which is less white than that obtained by the precipitation of calcii chloridum with sodii carbonas.

Magnesii carbonas is a fine white powder obtained by precipitating magnesii chloridum with sodii carbonas and treating it like the foregoing.

Acidum silicicum was recommended some years ago as a base in place of those commonly employed. An aqueous solution of sodii silicas is precipitated with acidum sulphuricum or hydrochloricum. In this way a jelly-like acidum silicicum is obtained, which is washed with water after from ten to twenty filterings. In this gelatinous form the acidum silicicum may be used in soaps and pastes; and dried and finely pulverized, it may be used for toilet purposes and white cosmetics.

The agents named form merely the base of the white cosmetics; since, however, they conceal too slightly the natural color of the skin and pigmentation, other strongly white coloring matters are added. As such should be mentioned zinci oxidum, which is obtained by heating zinc, or by precipitating zinci sulphas with sodii carbonas and heating this. The first-named product is the zinc white, flores zinci, of the shops.

Zinci oxidum is a fine, white, loose powder, insoluble in water, but soluble in acids. It should only be used after having been carefully cleaned. An excellent preparation is sold under the name of zinc white.

Bismuthi subnitras, bismuth white, is a very white, fine, crystalline powder obtained by dissolving bismuth in acidum nitricum and precipitating with water. It is insoluble in water and is of acid reaction. The magisterium bismuthi prepared according to the German and Austrian Pharmacopœias does not contain arsenic; in the market many preparations are found containing arsenic, and they are of variable composition. They are called Spanish white, pearl white, blanc de perles. Under the same name and for the same purpose other salts of bismuth are used, such as bismuthi chloras, acetas, and carbonas.

Barii sulphas, permanent white, blanc fixé, is obtained by the decomposition of barii chloridum with sodii sulphas, and is found in the market combined with water in the form of a paste, since it loses in fineness and concealing power by becoming dry; barii carbonas is also used in cosmetics.

Plumbi carbonas, cerussa, céruse, is made in various ways. The white leads of different manufacturers have a different concealing power. Usually it consists of sixty-six per cent of plumbi carbonas. It is glaring white, insoluble in water, and soluble in many acids, among these acidum nitricum and aceticum, and in dilute potash-lye. The finest sort is called Kremser white; pearl white is white lead made slightly blue with indigo. Other salts of lead, such as plumbi chloridum, are used, but are less white and concealing.

Of the preparations named, talc powder is the simplest and most innocent. It is insoluble, is affected neither by the skin secretion nor by the atmospheric moisture, does not stick together, and has a pure white color which is not changed under the influence of chemical agents. It acts on the skin only as dust; its disadvantage is its weak color and slight concealing power. Magnesii carbonas and chalk are also innocent; the latter, long used for this purpose, colors strongly and conceals well. The white produced by this agent is dull and earthy. Of the metallic agents, white lead is the strongest, finest, and best concealing white. As said above, however, it is so poisonous that it cannot be employed in cosmetics

even for occasional use. Although the sale of cosmetics containing lead is forbidden in Germany and Austria, new cosmetics containing lead are continually being sold under attractive names. But apart from the poisonous properties of lead preparations, their habitual use should not be permitted, since they often color the skin black by forming a plumbi sulphidum with the free hydrogen sulphides of the air or with the sulphur combinations secreted by the horny tissue in many individuals. Women who use cosmetics containing lead are often surprised, after taking sulphur baths, to see their faces turn gray or black. Barium white is almost equal in color and concealing power to white lead; it is innocent, and is not changed by hydrogen sulphide. Bismuth white, which is commonly supposed to be innocent, has not so strong a color nor so great a concealing power. The preparations containing arsenic are of course poisonous. The soluble bismuth compounds, such as the acetate, because of their caustic or at least strongly astringent action, are injurious impurities of the bismuth white. It should be mentioned that pure bismuthi subnitras concentrated in salve form and rubbed energetically into the skin may cause irritation and superficial dermatitis with unsightly scaling of the skin, an effect which may be employed for the removal of ephelides, as we have seen before. It would seem that this action depends on the solubility of the preparation in the secretions of the skin, the slightly caustic action of the solution being increased by the mechanical irritation of rubbing. In this manner may be explained the harmfulness of the continued application of zinci oxidum, the most frequently used coloring and concealing agent, and one comparatively uninjurious.

The base of the cosmetic is, as a rule, talc when a good concealing or coloring cosmetic is wished. In toilet powders for every-day use, for keeping the skin dry and protecting the complexion, since the talc powder betrays its presence, a quantity of some starch is added to it. In most cases the best composition for a concealing powder is zinci oxidum 6, talc 10, and magnesii carbonas 1; a stronger white is talc 5, zinci oxidum 8; much smaller quantities of bismuth or barium salts are sufficient. For toilet powder the composition should be amylum 2 and mineral substances (not metalic salts) 3.

In the selection of the agent, attention is given to the

degree of adherence to the skin; in a toilet powder adherence is not a desirable quality, the powder should brush off lightly from the skin; in coloring powders, a considerable degree of adherence is desirable.

Zinci oxidum and gypsum, which adhere strongly, should be mixed to white powders in but small quantities; talc and [illegible] do not adhere well. Often, when the skin is very [illegible] the best adhering agents, such as zinci oxidum and [illegible] are not sufficient; in such cases a small amount of greases such as spermaceti, or cocoa butter in the winter-time may be mixed, forming a grease powder.

[illegible] should be said of the color of the white cosmetics. The white powders or cosmetics disfigure the skin; [illegible] the skin normally delicate rose or chamois colored [illegible] covered with flour (clown face); darker colored [illegible] bluish-white from the color of the skin [illegible] In order to prevent the second, a trace of [illegible] white powders; in the first case, the [illegible] slightly with carmine or with carmine and

[illegible] The red cosmetics have as a base the [illegible] white cosmetics, talc powder, which may have [illegible] added to it, in order to lessen a too lively red. [illegible] coloring matters, carmine is most extensively

[illegible] the red coloring matter of cochineal, coccionella [illegible] Dactylopius cacti, dried), which consists chiefly of [illegible] with small quantities of alumina and lime.

[illegible] carmine, cochineal is boiled in ten parts of rain-[illegible] again several times after the addition of alumen, [illegible] exposed to the air in shallow vessels, in [illegible] the best sort of carmine is gotten. After an-[illegible] cochineal is boiled in seventy-five parts of water, [illegible] potassii nitricum, and later potassii oxalas, is added, [illegible] again boiled, and the further steps in the process [illegible] the precipitating method. Since the carmine acid, like [illegible] forms colored compounds with the metallic oxides, [illegible] may also be obtained by adding these. Alkaline [illegible] be used to make an extract of the cochineal, possibly [illegible] the addition of acidum citricum. The carmine remains in the cochineal decoction after the precipitation with

alumen may be got by boiling with albumen and is an especially fine carmine for cosmetics (Débay). The action of sunlight is supposed to increase the beauty of carmine.

Carmine is odorless, insoluble in water, soluble in ammonia, and is injured by soaps and alkaline fluids. A solution of carmine in five or six parts of ammonia is the so-called fluid carmine. Carefully heated in small quantities, carmine may be obtained as a dark purple-red or violet powder. In thin layers dry carmine gives a fine green reflex.

Much older and more extensively used as a cosmetic agent is saffron. This is the flower of the carthamus tinctorius, which, besides a yellow pigment soluble in water, has a red pigment carthamine or saffron red, soluble in alcohol.

The latter is used in place of saffron, and is obtained from this by extracting with soda solution and precipitating with acidum aceticum, perhaps purified by being dissolved a second time in soda, and precipitated with acidum citricum; it is a brownish-red powder having a greenish reflex.

Carthamine seems to have been employed in the most ancient times; at any rate, the word karthami appears in the Hebrew. In the renaissance and baroque periods, Spanish or Portuguese red was the most important red cosmetic agent. Carthamine is also called rouge or rose végétal.

Less red cosmetic paints are produced from Pernambuco wood.

The extracts of Pernambuco, red Brazil wood, and cæsalpinia contain the chromogen brasilin, of a carmine color and soluble in alkalies, which with metallic salts forms a lake. Pernambuco lake is generally dissolved in water and precipitated with acidum citricum.

Alloxan is less frequently used. It is a product of the oxidation of uric acid, in the form of colorless rhomboidal crystals, soluble in water and giving to the skin a purple-red color and an unpleasant odor. Alloxan has a more intense color than the other agents mentioned.

In later times, red cosmetics have been made from eosin. It is probable, however, that eosin itself (tetrabromide of fluorescin) is not often used, but its compounds with potassium and barium, which are in the form of crystals dissolving in water and alcohol with a play of colors, red and gold-green. Cosmetics prepared with this coloring matter, as well as those

prepared with cinnabar, have a peculiar rose color with a trace of yellow, and therefore are not used like the ordinary red cosmetics. I believe that these are adapted for use under the light of an electric arc lamp.

Cinnabar, hydrargyri sulphidum, is yet to be mentioned, a color valued in painting for its fire, but because of its yellowish tone it is scarcely adapted for imitating the natural red of the skin even when mixed with considerable white. It is used, nevertheless, as a cosmetic color; it is entirely insoluble in water and is poisonous.

3. Besides the red and white cosmetics there are those of other colors and of minor importance.

All have as a base the simple white cosmetics.

Blue is gotten by indigo, which is soluble in water, or by Berlin blue, which is insoluble in water.

Brown and yellow cosmetics are made by adding ochre, umber, burnt sienna, or Armenian bole. Umber, the well-known mineral color used in painting, is in reality ferri silicas with manganese and some aluminium. The best sort is the Turkish, which comes from Cyprus. Ochre is a natural ferri oxyhydras mixed with clay and lime. The others have very much the same composition, lacking, however, the manganese and having more clay. The chestnut-brown terra di Sienna comes from Tuscany; the finest sort of red bole, the Armenian, has often a trace of yellow. Other colors, such as minium and chrome yellow, are used only as stage cosmetics. Lampblack and boneblack are used in salve form without the addition of white cosmetics.

In order to color cosmetics with soluble colors, these are dissolved in alcohol or water and thoroughly rubbed up with a little of the cosmetic; then more of the cosmetic is added gradually and mixed until the whole is colored and dry. Insoluble colors, which must be finely pulverized, are also rubbed up gradually with the white cosmetic. In order to get a powder as fine as possible, the color is moistened with alcohol or water during the rubbing; after it is entirely dry it is again rubbed up and pressed through sieves and fine cloths. For perfuming, essences and extracts are used, which are also rubbed into the powder.

Toilet Powders.

℞ Amyl. pulv., ... ℥ viij.
Lapid. baptist.,
Talci veneti,
Alum. plumosi., ... ää ℥ iv.
Ol. rosæ, ... gtt. xxv.
Ol. neroli, ... gtt. xij.
M. S. Pulvis cosmeticus albus cum amylo.

℞ Amyl. oryzæ, ... ℥ xvi.
Bism. subnitr., ... ℥ iiiss.
M. S. Face powder (Piesse).

℞ Amyl. pistaciæ, ... ℥ xvi.
Talci veneti, ... ℥ xvi.
Ess. rosæ, ... gtt. iij.
" lavandul., ... gtt. i.
M. S. Poudre de toilette à la pistache (Piesse).

As with perfumes, cosmetics are often given names which have no connection with the principal ingredients of the cosmetic. Snow,[81] who analyzed a number of face powders, says of pistachio powder: "It is made of fine talc which is colored slightly lavender, well perfumed, put in elegant sachets, marked with a French label, and sold at an exorbitant price."

℞ Talci veneti alcohol., ... ℥ iss.
Zinci oxidati, ... ℥ iiss.
F. c. pauxillo indigo et essent. odor. pulv. cosmet.
S. White powder.

℞ Zinci oxidati, ... ℥ vij.
Talci veneti, ... ℥ xi.
Magnes. carb., ... ℥ i.
Ol. millefleurs, ... gtt. xxv.
M. S. Pulvis cosmeticus albus.

℞ Pulv. cosmetici albi, ... ℥ xviss.
Carmini soluti, ... gr. viij.
M. S. Rose powder (pulv. cosm. rubr.).

℞ Pulv. cosmetici albi, ... ℥ iiss.
Carmini sol., ... gr. i.
Ochre, ... gr. xvi.
M. S. Powder (Rachel).

These and the preceding powders cannot be called color cosmetics; they are really only slightly-colored white cosmetic powders. Even the following powders cannot be considered color cosmetics. I have used them on brunettes, where they looked as white as the skin of the hands; in very pale persons, however, they appear brown:

℞ Pulv. cosmetici albi,
Pulv. cosmetici rubri, ... āā ʒi.
Ochre, ... ʒiss.
M. S. Powder (Rachel—dark).

Other white powders are as follows:

℞ Talc. venet. alcoh., ... ʒxviss.
Bismuth. oxid.,
Zinci oxid., ... āā ʒi.
M. S. Poudre de perle (Piesse).

℞ Siliciæ subt., ... ʒiij.
Tal. ven. alcoh., ... ʒiss.
M. S. Blanc nouveau (Débay).

℞ Bismuth. subnitr., ... ʒss.
Cretæ gallic. (talci), ... ʒiss.
Amyl. tritici, ... ʒij.
Terræ albæ (gypsi), ... ʒiij.
M. S. Swan's down (Snow).

℞ Bismuth. subcarb., ... ʒvi.
Zinci oxid., ... ʒij.
Talc. venet., ... ʒiiss.
Cretæ præcip., ... ʒiiss.
Amyl. tritici, ... ʒiiiss.
M. S. Saunders' Bloom of Ninon (Snow).

℞ Zinci oxid., ... ʒij.
Talc. venet. alc., ... ʒvi.
Aquæ sapon. modice gummos. q. s. f. pasta ex qua form. trochisci.
S. White in tablets (Débay).

℞ Cretæ præcip., ... ʒiss.
Talc. veneti, ... ʒij.
F. c. s. qu. aquæ tabulæ.
S. Lily white tablets (Snow).

℞ Barii sulph.,. . . . . ℥ x.
Zinci oxid., ... ℥ xvij.
Talc. venet., ... ℥ v.
M. S. Barium white (Blanc de cygne—Débay).

Red Cosmetics.

℞ Carmini opt., ... gr. xvi.–ʒ ss.
Talci ven. alcohol., ... ℥ ij.–℥ iij.
M. S. Simple red powder.

℞ Carmini opt., ... ʒ ij.
Talci venet. alcoh., ... ℥ iv.–v.
Solut. gummi. trag., ... gtt x.–xxv.
Ol. amygd. dulc., ... ʒ iss.–iij.
M. D. in oll. S. Rouge en pot.

Similar to the toilet powders are the cosmetics in the form of paste or tablets, and those which are found in the market in the form of impregnated cotton wool or crêpe. To make the first sort, the finely-powdered cosmetic is mixed with gum tragacanth and a little oil or water to form a paste, and then dried in a fitting shape by gentle heat. Colored cosmetics of this sort are made from strongly-colored talc powder.

Such paste preparations are carmine, rouge en pâte; a paste colored with carthamine and put into little cups, rouge en tasses; and brasilin mixed with talc and put in little pots, rouge en pot. Red impregnated cotton is called Spanish cosmetic wool, laine d'Espagne; crêpe prepared in a similar way is called crépons. Carmine may be spread on cardboard and in this form is called rouge in feuilles, rouge de Chine.

For preparing fluid cosmetics the insoluble white mineral powders are suspended in perfumed water; in order to make the suspension more permanent, alcoholic resinous solutions, such as tinctura benzoini, or solutions of ethereal oils, such as aqua coloniensis, are added. Active skin agents such as sodii boras are often added, but to no purpose. Carmine is dissolved in aqua ammoniæ and perfumed for the most part with rose.

Fluid White Cosmetics.

℞ Bismuth. subnitr., ... ℥ iiiss.
Aq. rosæ, ... ℥ x.
M. S. Blanc de perles liquid.

℞ Zinci oxid., ... ℥ iiiss.
Talci veneti, ... ʒ vi.
Aq. coloniens,
Aq. rosæ, ... āā ℥ v.
M. S. Blanc de neige.

℞ Talc. præpar., ... ʒ iiiss.
Glycerini, ... ʒ iij.
Sodii bor., ... gr. viij.
Aq. colon., ... ʒ iiiss.
Aq. destil., ... ℥ iiiss.
M. S. Oriental cream.

℞ Calc. carb. præp., ... ℥ ss.
Bismuth. oxychlor., ... ʒ ij.
Rad. ir. flor., ... ℈ ij.
Glycerini, ... ℥ i.
Aq. destil., ... ℥ iiss.
M. S. Liquid pearl (Snow).

Fluid Red Cosmetics.

℞ Potassii oxalati, ... gr. viij.
Aq. destil., ... ℥ viij.
Spir. vini rect., ... ℥ ss.
Carmini opt., ... gr. viij.
Amm. p. liq., ... gr. iv.
S. Rose liquide (Débay).

℞ Carmini opt., ... ʒ i.
Amm. p. liq., ... ʒ i.
Aq. destil., ... q. s. ad ℥ iss.

M. S. Fluid red. This solution, given by Martindale, may be added to cosmetics, or one teaspoonful to a tablespoonful added to one-half pint of water makes a very good red cosmetic.

℞ Zinci oxid.,
Calc. præp., ... āā ℥ ss.
Ol. bergam., ... gtt ij.
Carmini, ... gr. iij.
Aq. destil., ... ℥ iv.
M. S. Fluid red.

In preparing grease cosmetics, the finest powder is used as in the preparation of the others; the salves used must be made from the purest fats. Since the grease cosmetics are chiefly rather hard pomades, tallow or wax is the best base. The grease cosmetics are either put in little pots, the historic rouge en pot, petit pot, or rolled into sticks. Fat powders have already been described.

White Grease Cosmetics.

℞ Pulv. cosmet. alb., s. rub., s. Rachel, . . ℥ iss.
Spermaceti, ... ʒ i.
M. exactissime. S. Fat powder.

℞ Bismuth, subnitr., ... ʒ iij.
Talc. præp., ... ʒ iss.
Ol. bergam., ... gr. xvi.
Ung. cerei, ... ℥ i.
M. S. Pomade for whitening the skin.

℞ Talci ven. alcohol, ... ʒ iiss.
Zinci oxdi subt., ... gr. xvi.
Spermaceti, ... ʒ iij.
Ol. amygd. dulc., ... ʒ vi.
M. ft. pasta. S. White cosmetic.

℞ Bismuth. subchlor., ... ʒ iij.
Barii sulph. præc., ... ʒ vi.
Ceræ alb. liquef., ... ʒ iss.
Ol. amygd. dulc., ... ℥ ss.
M. S. White theatrical cosmetic.

Red Grease Cosmetics.

℞ Carthamini, ... gr. xvi.
Talc. ven. alcoh., ... ʒ iiss.
Spermaceti, ... ʒ iij.
Ol. amygd. dulc., ... ʒ vi.
M. S. Red cosmetic (James).

℞ Eosin, ... gr. xvi.
Ceræ alb., ... ʒ ij.
Spermaceti, ... ʒ ij.
Saxolini, ... ℥ iss.
M. S. Rosalinde (Mrs. Pray).

℞ Alloxani, ... gr. viij.
Cold cream, ... ʒ ij.
M. S. Schnouda,

As to the method of the application of cosmetics, every one is guided by his own experience. In general, the choice of the cosmetic and the manner of its application must depend on the part to which it is to be applied and on the purpose for which it is worn—*i.e.*, whether it must serve for the house, for subdued daylight; or for the street, for full daylight; or for the stage, for artificial light; and whether the person is to be seen at a distance or near by. As a rule, dry cosmetics are used; these are serviceable for daylight as well as artificial light, especially when white and red are to be used. For this purpose the face is first greased with one of the solid pomades, such as paraffin, cold cream, or glycerin. No part of the face may be omitted and special attention is to be given to the entrance of the nose, the eyelids, and both surfaces of the auricle; the superfluous grease should be removed with a soft cambric cloth. White powder is then dusted on, and the superfluous amount also wiped off with a cloth. Next a more or less saturated red is put on near the mouth and nose and rubbed toward the ear. Since rosy ears are admired, these also must be covered. The cosmetic when applied must be exactly as desired; corrections are not often successful. If it be not altogether right, it is better to remove it and begin anew. For laying on the white powder, a hare's foot is used or a bit of down from the skin of a swan or goose; for the actual cosmetics a tampon is preferred, made of white plush or a very soft thin cambric. For artificial light and when the face is pale only red is used, a red grease cosmetic being applied to the previously oiled skin. For this purpose a cloth is used, or simply the fingers. The red cosmetic is best made by rubbing up fine carmine and glycerin with the finger. This is then applied to the cheek and spread out with a soft cloth; with some experience this is very successful. Blondes should not use too much red. Moist cosmetics are applied with a soft camel's-hair pencil, left until dry, and the excess then wiped off with a cloth. Experienced persons never use these on the face—at the most on the arms and neck, since the white that they give is too intense and makes the complexion sallow and

yellow under artificial light. Of all the cosmetics, the most harmful are the moist ones, since they are more sure to cause comedones; for this reason they should not be used on the face.

As a rule, this broad use of the cosmetic is not enough; detail must be added later. The nostrils are made red with grease cosmetic, the internal canthus of the eye is reddened, and the palpebral fissure is lengthened by a black stripe outward from the external canthus. A similar stripe is drawn on the hairy border of the lower lid, to make the eye brilliant and conspicuous. In order to give the face a certain je ne sais qua of revery or wantonness, a weak, black shadow is laid on the lower lid corresponding to the orbital margin, and this makes the eye seem deeper and more languishing. All these little deceptions are necessary for the appearance on the stage,[32] but often enough they are made use of in the common comedy of our daily life, and when not artistically applied, they appear like flecks of powder when seen in the house or on the street, and like hollows in the cheeks when seen on the stage. The eyebrows and the lips must also be spoken of. The former, when too short or thin or light, are lengthened and darkened with brown or black (lampblack) grease cosmetic applied with a soft brush. The shape and direction is also improved and the deception is made more complete by the fine marks of the brush. If not too great an effect be required, this may be gotten by means of an almond half-burnt over a candle, or the black cosmetic may be applied with a pin when it is only wished to give a better arch to the brows; in this manner may be drawn the line on the border of the lid next the lashes, or the line for the purpose of lengthening the palpebral fissure. Lips which are too narrow and too pale are often treated with cosmetics. Only red grease cosmetics and such as are not poisonous, cinnabar being excepted, are to be used. The paint must never reach beyond the margin of the mucous membrane. The broadening of the red line of the lips with paints is practised only on the upper lip, and there only in the middle at either side of the filtrum. A lengthening of the mouth would hardly be undertaken by any woman in her right mind.

In removing cosmetics, water may be used for simple powders and moist cosmetics. Grease paints, and powders which

have been applied to the previously greased skin, are to be removed by rubbing them with grease; after this is accomplished the skin may be cleaned with soap and water.

Perfumes.

Perfumes, odoramenta, are considered cosmetic agents only in so far as they serve to give a pleasing odor either to the surroundings of an individual, his clothes and toilet articles, or to his person itself. We shall not discuss the question here whether the indescribable, scarcely perceptible odor of a fresh, sound, and cleanly skin be not better than any artificial odor. From principle we should prefer the former: "Male olet, qui bene olet." No one, however, will deny that the odor from many faint perfumes combined, used by a lady of taste, that odor which is indefinable yet having its own peculiar character, may be pleasing and agreeable. This perfume is composed of a number of odors which the linen, the dress, the gloves, the soap, and the house, give a woman without she herself having been directly perfumed. In this way all perfumes are to be reckoned with the embellishing agents. Perfumes for the toilet have been used from the most ancient times. The agents now employed are mostly old, but great progress has been made in the matter of preparation and preservation of these, with the assistance of chemistry and an improved technique. In diluted form, as perfuming agents are commonly employed, they have merely an agreeable effect on the organ of smell; in concentrated form, whether taken internally or applied to the skin, they have a physiological effect, irritating the part to which they are applied and antiseptically preventing decomposition. Whether a given odor be pleasant or not is a matter of individual taste; for many persons, excluding those with a morbid sense of smell, hysterical usually, certain odors may be unbearable, while to others they are agreeable. Many perfumes which are disagreeable when concentrated are pleasing when diluted; others which are unpleasant when used alone combine to form pleasant mixtures. In the proper mixture of different perfumes consists the art of the perfumer. It is rare that even a trained nose can pick out the individual odors from such a mixture. To discover differences of quality in perfumes of one sort, or to distinguish substances which

have a similar odor, is not possible to any great degree, since the sense of smell in man is, in our day at least, very little practised or developed.

The substances used as perfumes are either contained in animal excretions and secretions or in plants. Some of the latter may also be artificially produced, and some may be made by chemical processes.

Drugs of animal origin used in perfumery are the following:

Ambergris, a light, dark, or ash-gray mass, softened by heat and melting into an oil, of peculiar, not exactly pleasant odor. Its origin and composition and its odorous principle are not fully known; its origin and composition are the subject of much conjecture.

Musk, moschus, granules and lumps of dark red color and peculiar, penetrating persistent odor.

The Empress Josephine, wife of Napoleon I., was a great lover of musk. Her toilet chamber in Malmaison, although washed, scraped, and painted repeatedly, still emitted the odor of musk forty years after her death (Piesse).

Musk is the secretion of special glands in the region of the umbilicus in the male musk-deer (moschus moschiferus, L.). The moschus tonquinensis is more valuable than the moschus cabardinus. The odorous principle of musk is scarcely known; we know only that the odor is more intense when the musk is moistened or when combined with weak alkalies.

Civet is a yellow or brown salve-like mass, which when undiluted has a disagreeable odor, found in the anal pouch of the civet-cat, vivena civetta. The nature of the odorous principle is unknown.

The odorous principles of these three drugs dissolve in alcohol; the tinctures so made (ambra 1:50, musk 1:150, civet 1:150) are too intensely odorous to be used directly as perfumes, but are added as odoramenta to soaps and smelling powders. Musk is adapted as a perfume for soaps when they are not too alkaline. These agents are important in perfumery, since they render fine, delicate, and fugacious perfumes permanent, and so serve as a fixing agent. Castoreum, the secretion of the inguinal sacs of the beaver, is used for this purpose, and also the scaly tail of the muskrat, fiber zibethicus, which has an odor similar to musk.

In the vegetable kingdom the number of perfumes is very

considerable, and their preparation offers no difficulties except as to the matter of expense.

Some genera of plants are very rich in odors, as the Labiatæ, which contain the Lavandula sp., Origanum majorana, Melissa offic., Mentha viridis and piperita, Rosmarinus offic., Salvia off., Thymus serpyllum and Pogostemon Patchouly; the Umbelliferæ, among which are the Anethum graveolens, Pimpinella anisum, Fœniculum vulg. and also the Opopanax chironium; the Leguminosæ, to which belong the Myroxylon peruiferum, Myroxylon toluiferum, Acacia farnesiana, Dipteryx odorata, and Santalum album; of the Irideæ, the Iris florentina; of the Orchideæ, the Vanilla planifolia; of the Liliaceæ, the Polyanthes tuberosa; of the Coniferæ, the Juniperus virginiana; of the Lauriaceæ, the Cinnamomum camphora, Laurus Cassia; of the Graminaceæ, the Andropogon Schœnanthus muricatus, nardus; of the Caprifoliaceæ, the Sambucus nigra; of the Magnoliaceæ, the Illicium anisatum; of the Rosaceæ, the Rosa centifola and damascena; of the Geraniaceæ, the Pelargonium odoratissimum; of the Convolvulaceæ, the Convolvulus scoparius; of the Resedaceæ, the Reseda odorata; of the Violaceæ, the Viola odorata; of the Styraceæ, the styrax benzoin. and officin.; of the Myrtaceæ, the Myrtus communis, Caryophyllus aromaticus; of the Aurantiaceæ, the Citrus Bergamia, medica, aurantium; and of other orders, the Acorus Calamus, the Narcissus odor., poeticus, the Heliotropium peruvianum, the Jasminum odorat., and the Plumeria alba.

In some plants the perfumes are in the blossoms, as in the acacia, heliotrope, violet, etc.; in others in the herb itself, as in the mints, patchouly, etc., or in the fruits and seeds, as in most of the Umbelliferæ, in the rind, as in cinnamon, or in the root, as in the iris. In many plants the odor pervades the whole plant, and in others the flower, the leaf, and the fruit each have their peculiar odor. In some plants, as the balsams and resins, the natural or artificially obtained secretion furnishes the perfume.

These odorous principles have the general name of ethereal oils; these are, as a rule, mixtures of at least two substances, a hydrocarbon like turpentine and oxygenated compounds—camphors, phenols, aldehydes, ketones, esters. The latter substances produce the odor in most cases. The ethereal oils are mostly fluid at the ordinary temperature; many of them when

cooled separate crystalline substances called stearoptens, while the parts remaining fluid are called elæoptens. It is now possible to prepare the ethereal oils in bulk, almost free from turpentine, and these are, therefore, more intense in odor.

Such ethereal oils are called concentrated or patented. All ethereal oils partly decompose under the influence of light, air, and heat; they become oxidized, and their color and odor are altered. They must be protected from the air and light.

The ethereal oils are found in most cases already formed in plants or dissolved in the cell contents; in a few cases the ethereal oil is formed by fermentation with water.

To obtain the oils from the plant, either the part containing them must be destroyed by pressing and distilling it, or the oils must be extracted by suitable solvents. The parts can only be subjected to high pressure when they are rich in oils, as in the case of the rind of the fruits of the Aurantiaceæ. The oil which escapes is separated by settling from the watery mucilaginous fluid of the tissue of the rind.

In distilling, the parts or the whole of the plant is put into an iron, copper, or glass retort, heated either with water over an open fire or with steam, the vapor cooled in the usual manner, and the distillate received in so-called Florentine bottles when the oil is specifically light, or in bottles with a lateral opening near the top when the oil is heavy. In the water which has passed over a quantity of the oil usually remains suspended, and may be obtained by dissolving it in a suitable agent. This, however, is not usually done, and the distillates, which have taken on the peculiar odor of the ethereal oil, are used as aquæ destillatæ. If the quantity of the oil obtained be too small, the whole distillate is poured over new parts of the plant, and distilled a second time. This procedure is called cohobation. In most cases an ordinary water, poor in salt, is used; in many cases, however, it is well to add salt to the water. Finally, very dilute alcohol may be used for the distillation. This operation should be used for materials which are not easily decomposed by heat.

With many plants whose ethereal oils are not obtained fine enough or in sufficient quantities by distillation, maceration is employed. In this process the flowers are thrown into tallow and lard or olive oil heated over a water-bath, and left here from twelve to forty-eight hours. This may be repeated

with fresh flowers. The oils take up the odorous substances, which can then be extracted by treating with alcohol. Oils so prepared are called huiles antiques. Orange blossoms, roses, acacias, violets, and mignonettes are treated in this way. This process is often combined with the following.

Absorption or enfleurage is chiefly used for such substances as do not tolerate the temperature of 104° to 122° F. which is required for the maceration; for these a layer of fat two and one-half inches deep is placed on inclosed glass tables and the flowers are strewn on this. After from twelve to seventy-two hours the flowers are replaced by new ones. In order to perfume oils, bits of coarse cotton wool are dipped in pure olive oil, laid on suspended nets, and strewn with the flowers, which are changed after a certain time. The perfumed oil is then pressed out of the cotton wool.

The so-called pneumatic method consists in passing a current of air or carbonic oxide gas through a vessel filled with flowers, and letting the perfumed air pass into a second vessel in which fluid fat is kept in constant motion.

The odorous substances may also be taken up with ether, chloroform, or petroleum ether. This is done in an extraction or displacement apparatus. The solutions are then subjected to distillation at as low a temperature as possible, and the remainder of the solvent removed from the odorous substance by passing a current of air or carbonic acid gas through it.

From these perfumed fats, by means of long-continued maceration with pure alcohol free from fusel oil, alcoholic solutions of the odorous substances are obtained, which are called extracts or essences. These essences are either used directly as perfumes or in their preparation, or for perfuming other cosmetic preparations. Even after long maceration, the fats do not give up all their perfumes to the alcohol, but a certain delicate odor is always retained, and such fats may be employed in the preparation of pomades and hair oils. The pureness and fineness of the odor of the extract depends on the quality of the alcohol used; certain perfumes are best obtained by being dissolved or distilled in spirits of wine, while for others corn spirits are preferred.

One must not imagine that the essences prepared from the plants named above are always of a pleasing odor, even though the natural perfume of the plant was such. Many of

these perfumes, especially in alcoholic solution, are much too weak and do not last; several of them are, therefore, mixed together, one, a strong perfume, serving as the basis. For such fixation, tinctures of the animal perfumes are used, as well as the essence of vanilla, tonka bean, etc. Many of the extracts sold have no more to do with their flaming plant names than this, since the production of their ethereal oils or essences would be much too dear. The ethereal oils of Lonicera caprifolia, Gaultheria procumbens, Cheiranthus Cheiri, and Syringa vulgaris may be obtained. The extracts of these, however, are generally made by mixing other odorous substances. Genuine extracts of the wild rose, the lily, the jonquille, the magnolia, and the garden pink are not to be obtained. The similarity of the odor of the mixtures to that of the plants named is certainly considerable, but for an educated nose not so great as the perfumers would have one to believe.

Products of chemical industries are also employed, artificial varieties of ether such as valerianic acid ether, benzoic acid ether, etc., and their mixtures.

The form in which the perfuming agent is to be used depends on the purpose for which it is to serve, and has been already treated of in part.

Drugs having a strong and lasting odor are pulverized and mixed in sachets of paper or elegant fabrics, and serve for perfuming the linen, the gloves, and the clothes in the drawers. For this purpose may be used iris root, vanilla, tonka bean, vetiver root, cedar and sandal wood, pinks, lavender and acacia blossoms, benzoin, ambergris, and musk. The odor of such mixtures may be intensified by the addition of strong-smelling, fine ethereal oils. These powders may be made into a pasty mass by means of tragacanth mucilage, and put in boxes with a perforated cover (cassolette, boule de senteur) and used for a similar purpose. For perfuming the linen and clothes peau d'Espagne is also used. This consists of two pieces of wash leather soaked in ethereal oils and gummed together with a mixture of balsams and resins of pleasing odor.

Perfumes are also used in fluid form. These waters serve not only for perfuming the clothes, but as solvents, since they are strong alcoholic solutions. What was said of alcohol and of balsams and resins applies also to the application of these waters.

The spirituous fluid perfumes may be added to the wash water, but it should be mentioned that this produces a milky emulsion-like fluid.

The aquæ destillatæ and the alcoholic aqueous distillates may be added to the wash water or used in place of this.

The toilet vinegars, which consist of solutions of ethereal oils in concentrated acidum aceticum, or of mixtures of essences with vinegar, since their chief constituent is vinegar and their action depends on this, have been spoken of in another place.

Finally, we should mention smelling salts, pastilles, incense papers and powders. Smelling salts, which are in reality perfumed ammonia and are used in nausea and fainting, come on this account within our sphere; the other preparations, since they are only used for perfuming the dwelling, do not.

Deodorizing Agents.

Apart from those agents which were mentioned among the acids and soaps, only chlorine and its preparations and potassii permanganas need be mentioned. We have already considered the action of both in hyperidrosis. Pure chlorine is seldom used, on account of its stifling odor; the same may be said of the eau de Labarracque and the eau de Javelle, which are solutions of potassii chloridum. These used in concentrated form are too caustic. They can be only used very much diluted as an addition to foot-baths, etc. A five to ten per cent solution of calcii chloridum, however, may be used, and since in itself it has little deodorizing power, it may be strengthened by the addition of a few drops of acid. All these chlorine preparations act well on skins which from any cause emit a bad odor; their effect is only momentary, and the treatment of the underlying disease must follow the deodorization.

Potassii permanganas is as efficacious as the others for temporary deodorization, but it has the disadvantage that the skin becomes brown after its use. It is, however, a preparation otherwise innocent, and is to be recommended for the removal of accidental bad odors on the hands and elsewhere, and should be on the washstand of every physician. The brown color of the skin may be removed by a solution of acidum oxalicum.

CHAPTER III.

THE HAIR AND NAILS.

The Hair.

The entire surface of the human body, with the exception of the upper lid, the lips, the inner surface of the hands and feet, and the distal phalanx of the fingers and toes, is covered with partly fine, partly coarse hairs. The former are woolly hairs, lanugo. These are either thin, flexible, and small, or larger, longer, and either more flexible or stiffer. The shorter hairs are not always the weaker; the hairs of the eyebrows and lashes and those about the openings of the nose and ears are strong.

The hair is a thread-shaped structure formed of epidermoidal tissue. It is divided into the point, the shaft, and the root. The latter is an obliquely-situated inversion of the skin, reaching, when the hair is large, into the subcutaneous cellular tissue, and provided with a number of sheaths. At the bottom of the hair follicle is an elevation, a papilla, on which the hair bulb rests. The papilla contains a vascular network and nourishes the hair. The hair itself contains a thin, cortical layer or cuticula, the fibrous part, and the medulla. The cuticula consists of cells arranged like overlapping tiles, the finer end directed toward the point of the hair; the fibrous part consists of spindle-formed cells running in an axial direction. These cells are not immediately joined; there are in the fibrous part numerous small, regularly-arranged spaces, which in health are filled with the fat of the sebaceous glands. In this layer is also the pigment, in solution and deposited in granules. The medulla, occupying one-fourth or one-third of the thickness of the hair, consists of large cells running in an axial direction; in the fine hairs this part is often wanting.

According to Pincus, the coarseness of the hair in general depends on the number of single hairs which contain a marrow. The hairs are arranged either singly or in groups. The groups consist of two, three, or possibly four hairs developing

together. On the hairy parts of the body the number of hairs varies not only according to their locality, but also according to the race and individual. In the fourth part of a square inch 293 hairs were found on the scalp, 39 in the beard, and 13 on the anterior surface of the thigh. According to Witop, a square inch contains 790 blond, 608 chestnut, 572 black, and 493 red hairs. The hair is solid, elastic, and hygroscopic.

The color of the hair depends on the quantity and quality of the pigment in the fibrous part. The intensity of the color decreases with the diameter. The color is often different in a single hair through disturbances in its nutrition. As the hair becomes gray, the pigment in the hair bulb changes from black to brown, red, or yellow, and finally disappears; the root is the first part of the hair to become gray. The hair turns gray first on the temples, then on the scalp, and later on the face and genitalia. As a rule, it is a sign of old age, but it may come on in younger life in consequence of hereditary disposition, or of severe diseases, or of sorrow and grief or sexual excess. Cases of the sudden turning gray of the hair are not rare in the literature. I shall merely refer to the case of Landois-Mosler, in which black hair turned gray with an attack of madness; the case of Brown-Séquard, whose beard turned suddenly gray; the case of Schenkel, in which the ciliæ became gray after a traumatic irido-cyclitis, and a number of cases reported by Pincus. The color of the gray hair depends often on the original color of the hair. Black or dark hair becomes silver white; blonde and light brown hair become yellow or yellowish-white. I have observed a case, however, in which both varieties came on together. The silver-gray hairs, apart from their diminished thickness, showed the configuration and the gloss of normal hair, while the yellowish-white hairs were of normal size, but flattened into a band form, twisted in long spirals, and had a slightly waxy gloss. Many of the latter pulled out easily. I have observed this change most frequently in dark beards, while the hair of the head remained black or showed here and there a silver-gray hair. There is also a milky-white decolorization of single bunches of the hair, partly with a lack of pigment in the underlying skin, partly with normal pigment. The former, vitiligo, is found in round or irregular patches in the hair of the head, the eyebrows, lashes, beard, and the hair of the genitalia. These spots may

appear as early as the tenth year and last through life. Since this, like the corresponding anomaly of the skin, resists all remedies, and is in many cases very disagreeable, it is an indication for dyeing the hair.

A cosmetic question of more importance is the falling out of the hair. According to Pincus, the average hair lives from two to six years, then falls out and is replaced by another. Every day a number of hairs fall out, the typical normal change. Among these are many hairs which are short and apparently young, yet which fall out under normal physiological conditions. In the normal change these short hairs should not form over one-fourth of the total number falling out each day. The daily number is usually from fifty to sixty. If it be greater it is anomalous. The hairs which fall out are provided with their bulbs for the most part. A bad barber, however, may break the hair above its root. One-fifth of the long hairs which fall out have a normal root; in the others this is clearer and thinner. In old age and in many diseases of the skin, the absolute number of the hairs falling out daily is larger, and the percentage of the short hairs is greatly increased. The hair then soon becomes thinner. In the ordinary chronic falling out of the hair, the individual hairs lose in length but not in thickness, and this stage passes as a rule unnoticed by the patient, while in the second stage the individual hairs become shorter as well as thinner, and the loss is readily recognized. In the further course of this trouble the amount of hair is lessened, and the individual hairs become thin, delicate, and poorly colored; later, nothing but lanugo hairs develop. Finally even these cease to grow, and an epidermal plug rests in the hair follicle. When the papillæ and the hair follicles atrophy, the baldness is permanent and incurable. This falling of the hair occurs usually on the forehead and at the vertex of the head, while the occipital portion below the level of the points of the ears remains, as a rule, hairy. There are, however, variations from this, as when the baldness extends symmetrically on both sides from the frontal protuberances toward the vertex, leaving a tuft of hair in the middle of the forehead.

Rapid baldness follows both severe general diseases and various skin affections. Such an alopecia prematura symptomatica appears after typhus and in simple syphilides of the

scalp. These cases get well, as a rule, after the cure of the underlying disease. Alopecia after deep inflammatory processes in the skin is usually permanent, and always so when the follicle has been destroyed by suppuration, by cicatrix formation, by pressure or cellular infiltration. In other diseases a scaling off of the skin occurs together with the loss of hair; this is called alopecia furfuracea. Although such a baldness comes on in many general diseases, together with an exfoliation of the skin, the former cannot be considered as dependent on the latter, but both come from a disturbance of nutrition. These cases of alopecia get well usually, but may last for months.

The true alopecia furfuracea is caused by a chronic seborrhœa of the scalp. This is entirely idiopathic, corresponding to the seborrhœa of other parts of the body, and comes on in both sexes, but more frequently in the male, without an ascertainable cause. It usually exists some time before it is noticed; the seborrhœa may get well of itself and permanent baldness remain. Since in thick hair there is naturally a formation of scales on the scalp, an alopecia seborrhoica cannot be easily differentiated from a simple alopecia in the first stages. The growth of new hair is hindered in seborrhoic alopecia by the seborrhoic process. By the overproduction of sebaceous matter and epidermis, the sheaths of the hair roots connected with the glands are either loosened or atrophied by compression, which is followed first by the formation of lanugo hairs, later by the destruction of the hair follicle. Seborrhœa and alopecia may develop in the eyebrows of persons of either sex, and rarely in the scalp of women and the beard of men. The duration of both affections is long, the prospects of recovery are unfavorable, and especially so in the alopecia seborrhoica in its subacute form.

Apart from seborrhœa and the causes mentioned here, the reason for the development of alopecia is obscure. Doubtless nationality and heredity play an important rôle, as well as the quantity and quality of the hair originally. Thick, coarse hairs not close together seem less inclined to fall out, while slender, delicate, and soft hairs fall more readily. It may depend in part on the difficulty of cleansing the hair in this latter case. The rareness of alopecia of the beard may depend on the same cause. That heredity has its influence is clearly

seen in many cases in which persons from fifteen to twenty years old become bald suddenly without appreciable cause, while the same thing has occurred in several generations. The care of the hair and of the scalp has certainly a great influence on the persistence of the growth of hair. The unsuitability of our head covering, with its lack of ventilation, is one of the causes of premature baldness, as is shown in the Orientals, who wear the fez constantly; the depravity of the modern youth may also favor the development of alopecia. Water in the form of washes or douches is another cause which may dispose to alopecia.

Another disagreeable variety of baldness is alopecia areata. The hair here falls out suddenly within a small area. The hairs in the neighborhood of these circular spots loosen and fall out, so that the bald patch may increase greatly within a few days; and when several of these develop and the disease progresses, the whole head may become bald within a few months. The bald scalp does not appear changed as a rule, but is smooth and white. The duration of this disease may be from a few weeks to two years; it gets well spontaneously, the hairs ceasing to fall out, lanugo hairs developing on the bare spots, and finally normally pigmented hairs. This is the ordinary course. In some cases the disease does not limit itself, the eyebrows, the lashes, the beard, and the hair of the body falling out. No definite cause has been ascertained for this disease. The idea of Kaposi that it is a trophic neurosis is plausible, but does not explain the disease altogether.

Microbes have also been supposed to be capable of causing all the varieties of alopecia; in alopecia furfuracea in particular, Lassar and others have accepted a pathogenic organism and have demonstrated the contagious nature of the disease. While no fault can be found with the observations of so good an investigator, still it must be remembered that there are a great number of cases of alopecia furfuracea which are not contagious, since under all the combined evils which this author speaks of, and especially the common use by the family of the same comb and brush, no contagion occurs. I hold the same opinion as the representative of the Vienna dermatological school in regard to alopecia areata, which Kaposi says definitely is not contagious. The hygienic rules which Lassar lays down should certainly be followed, since by the

use of common instruments by the barber, in public bathing places, and even in families, infections of other natures might occur; and the other injurious practices, such as the use of pure fats, etc., may favor the simple falling out of the hair without any bacteriological complication. The fact that anti-parasitic treatment may cure an alopecia areata is no evidence of its parasitic nature, since this disease, as said above, will often get well of itself.

Alopecia areata and idiopathic alopecia do not preclude the existence of each other. I have seen both together, and have also observed cases in which, shortly after the complete cure of an alopecia areata, an idiopathic baldness came on.

The treatment of baldness depends of course on the nature of the affection. Although Pohl-Pincus, Lassar, and others give therapeutic treatment for each variety, we are only certain of a result in alopecia seborrhoica. A proper caring for the hair and proper hygienic habits may prevent in many cases the idiopathic premature alopecia. The therapy of alopecia seborrhoica is, with slight exceptions, that of seborrhœa in general. However, the scales, which consist of fat and epidermis, must be first removed. When they are numerous, oil or grease should be applied in large quantities; when the crusts are softened, agents are to be employed which saponify the sebaceous matter and the crusts and emulsify the dirt. These agents are either alkalies or soaps; when the scalp is resistant, barrel soap, and when it is tender, fluid glycerin soap.

These soaps and the spiritus saponatus kalinus should be rubbed in vigorously, with the assistance of a flannel cloth or a bath glove. The soapsuds are to be washed off with luke-warm followed by cooler water or, better, with a douche. If the scalp become sensitive and fissured from this application, it may be protected by oils and pomades, which must of course be pure. Following this comes the actual treatment of the alopecia, which for the most part must be directed toward raising the tone of the sebaceous glands and hair follicles. For this purpose are adapted most alcohols and alcoholic tinctures to which acidum carbolicum, acidum salicylicum, etc., are added; balsamic agents and ethereal oils such as benzoin, Peru balsam, tar, and naphthol have a tonic action and are especially indicated when the underlying skin is hyperæmic

and tender. Tannin and quinine are also tonics. If there be no hyperæmia of the scalp, irritating agents like cantharides, capsicum, and veratrina may be used.

This method of treating alopecia seborrhoica is, with slight variations, given by most authors for the various sorts of alopecia. It is quite unimportant whether the scalp be first washed with an alkaline or tar soap, or with the mixture of soaps, potash, and soda recommended by Lassar, or with the solution of sodii bicarbonas recommended by Pincus. The effect desired is the saponification of the sebaceous matter of the scalp and the emulsification and consequent removal of the epidermis crusts. If one prefer, like Lassar, to substitute sublimate for the alcohol or alcoholic solution of an irritant, this is almost a mere matter of taste; and in the same way acidum salicylicum may be added to the oil which is rubbed in later. Neither sublimate nor acidum salicylicum are specifics in the treatment of any of these alopecias, as is shown by the great numbers of remedies recommended, of which one or the other had in a certain case a beneficial effect. Pilocarpine, either locally applied or injected subcutaneously, was recommended first by Schmitz, later by Lassar, as an agent increasing the growth of the hair. If any principle of treatment for alopecia is to be established, it consists in the employment of alkali, alcohol, fat, and irritants as we have described. The chief point in this, as in cosmetic treatment in general, is a rational hygienic care of the skin, which will be spoken of later.

Besides the changes described which affect the head of hair, there are also anomalies of the individual hairs which may accompany alopecia or which may come on alone. As a forerunner of alopecia, the single hairs become thin, brittle, dry, and lustreless, which changes may also be found in general diseases. A peculiar variety of atrophy of the hair is trichoptilosis. In such hairs the point is split up into fibres. This condition found in the long hair of women and in the beard of men may depend on a partial dryness of the hair (Kaposi) or on abnormal nutritive relations. It seems to me that the hairs in the partially whitening beard, which lose their cylindrical form and become flat, are especially disposed to this splitting. Another form of this disease, called trichorrexis nodosa by Kaposi, shows spherical or spindle-formed swellings on individual hairs of the beard and more rarely of

the scalp. At these places the hair is brittle without apparently being loosened at its root. The cause of this disease, which certainly depends on a disturbance of nutrition, is not known.

While trichoptilosis may be cured by frequent cutting and rational care of the hair, trichorrhexis is hardly to be cured by any agent if the hair is retained, and only in a few cases has it been cured by repeatedly shaving the hair.

Another frequent anomaly of the hair is its hypertrophy. By this is not meant the new development of hair, nor the excessive length and closeness of it in localities where naturally long and close hair grows. The long rich hair of some females cannot be called hypertrichosis, nor can the excessively long beard of some men. But those cases are called hypertrophy of the hair in which many parts of the body and the unbearded portion of the face are covered with soft, close blond or dark lanugo hairs, and the deformity, unpleasant in the female, where thick, dark, veritable beard hairs develop on the upper lip, chin, and other parts of the face. The hairy growth on warts and nævi belongs here also. These latter are the most frequent objects of cosmetic treatment, and next to these the more or less close, woolly hair on the face of females. Small, dark beard hairs on the upper lip of women are often considered piquant or even supposed to be becoming.

The cause of hypertrophy, leaving out of consideration heredity and race, is obscure. Women with dark skins, and southerners in general, frequently show the anomaly of a coquettish mustache. The abnormal development of this hair may depend in many cases on irregularities in the sexual sphere, in many cases perhaps on a local irritation.

The therapy of hypertrophy of the hair may vary. Simple shaving leaves the stump of the hairs visible, and habitually indulged in leads to pigmentation of the skin. When the hairs are present in considerable number it is best to remove them by means of depilatories. When the number is small they may be pulled out with the forceps; but since this method is painful and since it must be frequently repeated, it is not much used.

The newest method and one to be recommended is the epilation by electrolysis.

This operation is simple, and when made according to the

rules laid down by Lustgarten,[33] is entirely innocent. A positive sponge electrode is placed in the patient's hand, a negative needle electrode is pushed into the hair follicle. In the negative current a galvanometer and a rheostat are included. The current used is from one-half to one milliampère. After the introduction of the needle, the handle of the rheostat is turned and the current is allowed to act twenty to thirty seconds.

The action of the current is, as was said before, merely chemical. In consequence of the electrolysis, a frothy fluid escapes from the follicle. The reaction is slight and not very painful. The skin about the needle becomes first pale and later red. After a day or two, small brownish, dry crusts form at the point of entrance of the needle, which soon disappear without leaving a trace. From twenty to forty hairs may be removed at each sitting, repeated perhaps three times a week.

The bad effects of the operation are too strong or too extensive cauterization, and in consequence of this reddening and inflammation of the skin. These are to be treated in the usual fashion, and if proper care be taken, chiefly in regard to the strength of the current, they may easily be prevented.

The agents acting on the hair may affect the hair itself or the scalp. The scalp, like all skin, is elastic, of a color varying in different individuals and containing a certain amount of fat. The elasticity of the scalp is somewhat less than that of the remainder of the skin, since it is connected with the periosteum of the skull by a stiff connective tissue poor in fat, and by a very thin muscular layer. The more this tissue disappears with advancing age, the more its elasticity and turgescence diminish. The color of the scalp is always paler than that of the surrounding skin. In black-haired individuals it is more bluish, in blondes more reddish-white. If the hair disappears from the scalp or if it be shaved regularly like the beard, the color of the scalp comes to be more like that of the face. When the hair is regularly removed, either by the scissors or chemical agents, the color of the scalp becomes darker. The scalp is normally more oily than the remainder of the skin; the fat of the sebaceous glands serves to oil the hair, but under some circumstances the removal of the fat is prevented, and it remains on the scalp mixed with epidermis

scales as a seborrhœa capillitii furfuracea. On the other hand, especially in old age, the scalp may lack the necessary fat. The hypersecretion of the sweat of the scalp comes within our sphere and also the anomalies of elasticity of the skin and of the amount of fat contained in it, anomalies which affect the hair as well as the scalp. What is said here of the scalp will serve for the skin of other hairy parts.

The hair, the chief adornment of the human head, owes its beauty in part to the condition of the underlying skin and suffers with its anomalies. To the turgescence of the skin they owe their position and in part their secure fixation; to the fat of the skin they owe their lustre and their flexibility. The color alone does not depend on the skin but on the race to which the individual belongs, although, as already stated, pigmentary anomalies of the skin as a rule cause anomalous pigmentation of the hair or complete lack of pigment. If the turgescence of the skin grows less in age, the hair falls out; if the sebaceous glands produce too little fat, the hairs become dry and brittle; if there exists seborrhœa, the hair falls out with the epidermis scales; if the scalp is kept damp by hypersecretion of the sweat, the hairs become rough and lustreless and finally fall out.

Therefore hair cosmetics must be such as protect the hair from the bad influences of the atmosphere and other agencies, such as remove the foreign matter in an innocent way, such as give the hair a lustre and fine color and prevent its falling out. This latter, and further, that of making the hair grow again are the weak points in the cosmetic treatment of the hair. From the standpoint of the physician, it is clear that in most cases the hair can only be protected from injurious agencies.

A rational care of the hair will accomplish much; this consists first in the washing of the head. The intervals should vary according to the condition of the scalp as to whether it be too oily or too dry, from fourteen days to a month. When soap water has an unpleasant effect, the yolk of egg may be used for the washing. Too frequent washing or douching of the head is to be avoided. The hair is to be carefully dried after washing. To prevent dryness and tension of the scalp after washing, it should be oiled with pomades or pure oils. Combing or brushing the hair in the wrong direction is injurious, as is also the use of curling irons.

Fats.

The physiological action of these has been explained; they prevent the evaporation of water from the scalp and from the hair and so preserve the lustre, smoothness, and natural position of the hair. Hair which lacks these should have hair-oils and pomades used upon it. Grease protects the hair from dust, from the heat, from the wind, from moisture, and from sudden changes of temperature which injure the hair immediately or after a time. It is a much better preservative and cleansing agent for the hair than soap and water. Grease is the more indicated where the scalp is not oiled enough by the natural sebaceous matter. In diseases of the hair, when they split, or when they fall out, grease is frequently indicated. It is used with other agents in the treatment of seborrhœa capillitii, and alone in many parasitic affections of the head.

The use of grease on the hair is only contra-indicated in exceptional cases; when there is a normal secretion of fat, and the hair has its natural lustre it should not be used, as here it may make the hair fall out more quickly. On the other hand, very shiny hair is not pleasant to see. Laborers often use machine oil when they have no other fat, and I have seen one man who greased his head with petroleum. There are hairs which will not tolerate the use of grease. As a rule, pomades and hair oils should not be used oftener than two or three times a week, and when frequently used, the hair and scalp should be thoroughly cleaned each time with soap and water.

For purely cosmetic purposes, such as making the hair shiny, curling it or smoothing it, small quantities of the grease are to be applied to the hair. For curative purposes, as in many cases of the falling out of the hair, the scalp alone is to be rubbed with the grease; and in some cases, as for driving away parasites, both hair and scalp are to be rubbed with the grease.

Many fats are especially popular as hair pomades, since they are supposed to strengthen the scalp and increase the growth of the hair. These are the medulla ossium bovis, the fat combed from the mane of a horse, etc., and in ancient times the bone marrow of the stag (cervæ medullæ, Ovid) and ursinus adeps which Cleopatra is said to have used, and which many ladies suppose they use in the pommades à la graisse

d'ours. In place of most of these fats, lard is now used, apparently with the same results.

The first rule in prescribing hair oils and pomades is to be certain that only pure fat is used. The same reasons serve here as in the application of fats to the skin; the fats which may be used on the hair need, therefore, not be mentioned here. As a basis for pomades purified lard should be used, to which, in order to make it more permanent, one to five per cent. of acidum salicylicum or benzoin may be added. In place of this, fine resins and balsams may be used, which at the same time give a perfume to the pomade.

As the basis of hair-oils should be used one of the freshly-pressed seed oils, of which the simplest and best is the oleum amygdalar. dulc. By mixing solid fats with oils, pomades may be made of any consistence desired; for the summer the consistence is best increased by adding wax. In order to make pomades more pleasing to the eye, melted spermaceti or paraffin mixed with oil is allowed to cool slowly, producing a crystalline pomade; wax and spermaceti dissolved in fatty oils furnish transparent pomades. For perfuming pomades and hair oils ethereal oils or lard fats, or fatty oils (huiles antiques) are used, which have served for extracting odorous substances. These fats which by maceration in alcohol have given out the greater part of their odor, have still enough remaining to make them serviceable in the preparation of hair pomades (pommades épuisées). Many pomades are also colored. Rose pomades are colored with carmine or henna; brown pomades with lamp-black or umber; stick pomades are often colored green.

In order to make pomades more transparent and more solid, agar-agar is added. Other pomades which are to be used for fixing the hair are mixed with gums, glycerin, and alcohol. Apart from the fact that gums, agar-agar, and the like, stick to the hair and give it an unpleasing appearance, these are all injurious from the decomposition which they undergo. As for glycerin, mutatis mutandis, what was said of its injurious action on the skin, applies here. When glycerin is applied to the hair, it not only extracts water from the hairs and renders these less elastic and more brittle, but it catches the atmospheric dust and forms with it a thick paste which prevents the evaporation of the water and dis-

poses the hair to take up the infectious matters floating in the air.

Hair fats may have the consistence of salve, as in ordinary pomades; or the consistence of wax, as in the roll pomades (fixateurs); or they may be fluid, as in hair oils; or finally viscid, as in most brillantines. The following are serviceable:

℞ Adip. suilli,
Axung. benzoin., ... āā ℥ iv.
Pomat. rosat. gallic. (de Grasse), . . ℥ ij.
Ol. amygd. dulc., ... ℥ viij.
C. alcanna tinct.,
Ol. rosæ, ... ʒ ss.
M. S. Crême circassienne (Piesse),

℞ Axung.,
Sebi ovil., ... āā ℥ ij.
Ol. amygd. dulc., ... ʒ ij.
Bals. Peruv., ... ʒ i.
Træ. benzoin., ... ʒ ss.
M. S. Pomade (Débay); a simple and serviceable pomade.

℞ Pomat. tuberos. gall., ... ℥ iv.
Ol. ricini,
Ol. amygd., ... āā ℥ ij.
Ol. æth. berg., ... ʒ ij.
M. S. Castor-oil pomade.

℞ Ol. ricini, ... ʒ i.
Spir. vini rect., ... ℥ iss.
Ol. æth. flor. aur., ... gtt. ij.
M. S. Brillantine.

Castor oil is supposed to increase the growth of the hair. After its frequent use the hair gets a thick, greasy coating, as after the use of glycerin. In using these pomades and oils the hair must be very carefully cleansed.

℞ Medull. oss. bovis, ... ℥ i.
Ol. amygd. dulc., ... ʒ ij.
Ol. rosæ. . . . . gtt. iv.
M. S. Pomade.

℞ Cerae alb., ... 3 vi.
Ol. antiq. ros., ... ʒ iss.
" " acac.,
" " jasmini, ... āā 3 vi.
" " flor. aur.,
" " tuberosæ, ... āā ♏ vi.
M. S. Pomade philocome (Piesse).

℞ Ol. antiq. rosæ,
" " tuberos., ... āā ʒ iss.
" " flor. aurant.,
Cetacei, ... āā 3 vi.
M. S. Huile crystallisé (Piesse).

℞ Cerae alb., ... 3 i.
Cetacei, ... 3 ij.
Liquef. misce c.
Ol. amygd. d., ... ʒ viij.
Bombyfrig. agit. c.
Aq. rosæ,
Glycerini, ... āā 3 ss.
Ol. rosæ, ... gtt ij.
M. S. Crême neige. (On account of its small amount of glycerin, serviceable but not popular.)

℞ Cetacei, ... 3 i.
Paraffini, ... 3 ss.
Ol. antiq. rosæ,
" " violar.,
" " tuberos., ... āā 3 iij.
Ol. flor. aurant., ... 3 i.
M. S. Huile crystallisé (Bernatzik).

℞ Ol. amygd. dulc., ... ʒ iss.
Ol. antiq. jasm., ... 3 iij.
" " tuberos., ... 3 i.
" " flor. aurant., ... 3 i.
Ol. amygd. amar., ... gtt. ij.
M. S. Hair oil.

℞ Ol. behen., ... ʒ iiiss.
Ol. æth. bergam., ... gr. vi.
Tinct. ambræ, ... gtt. ij.
M. S. Hair oil.

℞ Axung. benzoin.,
Ceræ albæ, ... āā ʒ iss.
Pomat. jasmini,
" tuberos., ... āā 3 vi.
Ol. rosæ, ... gtt. v.
M. S. Roll pomatum (Piesse).

℞ Ceræ alb., ... 3 i.
Sapon. oleac.,
Gummi arab., ... āā 3 vi.
Aq. rosæ, ... ʒ iss.
Ol. bergam., ... ℈ ij.
Ol. thymi, ... gtt. iiss.
M. S. Hungarian pomade for the mustache (Piesse).

Agents used for Drying the Hair and Removing its Fat.

Agents Used for Dandruff.—In individuals in whom by nature the scalp is very oily, where there is an overproduction of sebaceous matter, and where this matter, together with the atmospheric dust and the cast-off epidermis, produces the disagreeable condition called dandruff, all varieties of fat-removing agents are indicated, and the choice depends on the degree of the trouble.

These agents are the alkalies, the soaps, and alcohol. They act here very much as on the skin, the two former by saponifying the fat and emulsifying the dirt, the latter by dissolving the fat and extracting the water. The action is somewhat different, however. The scalp is much more sensitive and delicate than the remainder of the skin, and is much more easily injured by harmful influences. Continued washing with alkaline fluids, the energetic application of these in concentrated form, and the use of too caustic alkalies dry the scalp, the skin seems too tight, and an annoying feeling of tension comes on. After the more intense application of these, the scalp becomes red, sensitive, and painful. The application of alcohol causes effects similar but not so intense. The hairs are very thin, horny structures which have nearly completed their term of life, and when frequently treated with alkaline

solutions, as may be seen in a simple test-tube experiment, they swell up, become transparent, lose their lustre and color, become partly dissolved and brittle; on this action depends the employment of depilatories. Alcohol affects the hair in a milder manner; it removes the fat completely, abstracts the water, and when its use is continued makes the hair rough. The caustic alkalies are here seldom employed, and even the simple alkaline carbonates are used only in weak concentration. The neutral soda soaps and sodii boras as well have a much milder action, but do not remove the fat completely.

These conditions furnish the indications for the use of the individual remedies. Soaps and sodii boras are used for simple cleansing, and for removing some of the fat from the normal hair and scalp, and the excess of fat after the use of oils and pomades. Solutions of the alkaline carbonates, weak solutions of the caustic alkalies, strong alkaline soaps, potash soaps, and spiritus saponus kalini are indicated in seborrhœa capillitii and when there is excessive formation of dandruff; alcohol and alcoholic fluids are indicated for drying the hair and removing its fat. The stronger agents are also used as preparatory agents before dyeing the hair, since here the fat must be entirely removed.

Since the dilute acids act in some respects like the alkalies, acidum aceticum and salicylicum may be used for dandruff, and also aromatic substances and balsams, such as benzoin and Peru balsam.

Soaps may be prescribed either in fluid form, as fluid glycerin soap, or in alcoholic solutions. In order to lessen the subjective symptoms which the washing with alcoholic fluids alone may cause, glycerin may be added. But since the latter is injurious to the hair, only small quantities of it should be used. The acids and the aromatic substances are given in alcoholic or in ethereal solutions. Alkalies and sodii boras are used in aqueous solution and only in small quantities; they are sometimes mixed with alcohol, which has no purpose.

Drying powders are given as such. They should not be strongly perfumed, chiefly since strong odors on the head are disagreeable, and also because cases are recorded in which a considerable addition of iris has caused nervous attacks and even epilepsy. For the removal of dandruff these powders,

especially the more active ones, may be prescribed in the form of salves.

Prescriptions for soaps may be found under the heading of soaps. For the other agents some prescriptions are given here:

℞ Potassii carb., ... ʒ ss.
Aq. destil., ... ℥ iiiss.
M. S. Dandruff water.

℞ Sodii bor., ... ʒ i.
Aq. destil., ... ℥ iiiss.
M. S. Idem.

℞ Sapon. oleac., ... ʒ iij.
Spir. vini gall., ... ℥ iiiss.
Aq. colon., ... ℥ iss.
M. S. Hair water; a mildly-acting remedy for dandruff.

℞ Potassii carb., ... ʒ iij.
Aq. destil., ... ℥ vij.
Vitell. ovor., ... No. iij.
M. S. Water for washing the hair. (The yolk of egg must be beaten until fully mixed.)

℞ Potas. carb., ... ℈ ij.
Aq. rosæ, ... ℥ iiiss.
Glycerini, ... ʒ iij.
M. S. Dandruff water.

The following are to be rubbed energetically into the scalp in the evening; in obstinate cases they may be left to dry and removed some days later with yolk of egg and lukewarm water or with yolk-of-egg soap.

℞ Ol. cocos,
Sebi bovini,
Liq. sod. caust., ... ää ℥ iss.
Vitell. ovor, ... No. vi.
Ol. de cedro, ... ʒ i.
Fiat via frigida sapo pond., ... ℥ iiiss.
M. S. Yolk-of-egg soap (Auspitz).

This may also be used alone in seborrhœa and dandruff formation.

℞ Acid. salicyl., ... gr. xvi.–℥ ss.
Spir. vini gallic., ... ℥ iiiss.
M. S. Dandruff essence.

℞ Acid. carbol., ... gr. iiss.
Spir. vini rect., ... ℥ iiiss.
Glycerini, ... ℥ ss.
M. S. Water for dandruff (Kaposi).

℞ Acid. borici, ... ℥ iij.
Glycerini, ... q. s. ad sol.
Spir. vini, ... ℥ x.
Ol. caryophyll., ... ℥ ss.
M. S. Water for washing in pityriasis capitis (Neumann).

℞ Acid. carbol.,
Bals. peruv.,
Spir. lavandul., ... ää ℥ i.
Spir. vini gallic., ... ℥ x.
M. S. Idem (Neumann).

℞ Spirit. ætheris, ... ℥ iiiss.
Træ. benzoini, ... ℥ ss.
M. S. Dandruff water (Hebra).

Among these agents are to be included a number of powders, some indifferent, some slightly astringent. For drying hair which is by nature oily, where the scalp is not over fatty, simple absorbent powders, such as rice meal and alumen plumosum, may be used in one of the forms already given.

Hair powders are used for hygienic purposes and as preventive agents, especially by women in severe diseases and in child-bed. The tangling of the hair and its loss in consequence of this may be prevented by the proper use of powder. In such cases a little acidum salicylicum should be added to prevent decomposition and its bad odor. To prevent the chilling of the scalp after the bath, powder may be used in many cases in place of fat. Since dry and rough hair appears thicker than that moist and oily, many women use powder to make a thin head of hair appear fuller. Nothing is to be used, however, when the hair is very oily, except the necessary cleaning. Powdering the hair for cosmetic purposes is not much done in our day, but is, however, practised by some women and indeed not to the detriment of their beauty. Those who are discon-

tented with the color of their hair and who do not wish to use dyes, powder their chestnut or red hair to make it appear blond. The use of gold or copper dust (gold powder) or glass dust (diamond powder) is now very rare.

If a strong astringent be indicated, as in severe seborrhœa or hyperidrosis of the scalp, the metallic salts already mentioned may be added to the powder, as for example zinci oxidum, plumbi acetas and carbonas, hydrargyrum præcipitatum, and bismuthi subnitras. These agents are more frequently employed in the form of salves. The prescriptions given may be used on the hairy scalp.

℞ Zinci oxid.,
Plumbi carb., ... āā ʒ i.
Ungt. pomad., ... ʒ iss.
M. S. Salve.

℞ Hydrarg. præcip., ... ʒ i.
Tinct. benzoini, ... ʒ ij.
Ceræ alb.,
Ol. amygd. dulc., ... āā ʒ i.
M. S. Salve.

The application of these agents is very simple. The alkaline fluids are applied two or three times a week with a soft brush; alcoholic solutions are applied with a sponge. If the hair itself is to be treated, single strands are separated with a coarse comb, moistened with a sponge, and dried with a soft cloth. To pour a quantity of fluid over the head and then to dry it by rubbing it energetically with a cloth, as persons with short hair are accustomed to do, is directly injurious. When crusts are present these are to be softened with oil, either by pouring oil on directly, or by rubbing it on by means of a bit of flannel. After the removal of these, soap should be applied with a shaving-brush or with a piece of flannel and finally washed off with warm water; in most cases the scalp should then be greased with salves or oils. When there is only a moderate amount of crust formation, the scalp should be rubbed every two weeks with spiritus saponis kalini in the evening and washed in the morning; besides this, the scalp should be washed with alcohol two or three times in the week, and once a week it should be greased. Salves are to be

rubbed on with the palm of the hand after the head has been thoroughly cleaned with soap.

Agents for Increasing the Growth of the Hair.

In the sense understood by the laity and perfumers we do not recognize such agents. There are, however, cases in which, with a rational care of the hair, proper agents may stop or lessen or delay the falling out of the hair. The active agents are but few, however, and only two or three need be mentioned. A number of these have been spoken of in the preceding, viz., alcoholic, balsamic, and alkaline medicaments.

They are softening and loosening in their action, like the alkalies, or of tonic action such as cinchona and quinine; others contain tannin; others alcoholic and balsamic agents; others are irritants, such as cantharides, sabina, veratrum, capsicum, hellebore, and ammonia; sublimate may be mentioned here, although not properly an agent increasing the growth of hair. Besides these, there are substances which are said to have a direct influence on the growth of hair, such as potassii iodidum and pilocarpine. A number of other substances having no specific action, such as the fats and bardana root, are also employed.

The agent to be chosen depends on the nature of the falling out of the hair; some of these, especially the alcoholic and irritant agents, may be injurious when long used, and since the course of the disease is often chronic and the application of the remedies must be long continued, they often do harm. They may either cause the hairs to become brittle or may give them an abnormal color. When alkalies are used, dark hair becomes lighter or reddish-brown, cinchona and tannin pomades make the hair darker, sabina makes it dirty gray or grayish-brown. The agent used must be often changed, and irritants are to be used alternately with emollients. Frequently agents of different sorts are combined.

Alkalies are indicated when the falling out of the hair depends on the formation of crusts; sodii bicarbonas has been recommended by Pincus in the first stage of the chronic falling out of the hair; tonics are, however, often useful in this condition. When the scalp is pale and the hairs do not grow long, further, in the infrequent cases in which the baldness

begins with the rapid falling out of the hair, cinchona in tincture or salve form is good. Although it is not proven that quinine is absorbed by the unbroken skin, experience shows the value of the application of quinine. It should, however, be added that the favorable results are observed especially after the use of preparations of the bark itself, which also contains tannin. A marked action of the alkaloid when used alone is seldom observed. With pomades of quinine and quininæ tannas the effect depends mostly on the action of the fat, and the peculiar action of the salt is seen only after energetic inunction with the pomade. The alcoholic agents are indicated in the hypersecretion of sebaceous matter and should not be used long, since they cause the hairs to break off. The irritants are rarely indicated; in torpid falling out of the hair, with a loose and oily scalp, in alopecia areata, the tar preparations, ethereal oils, cantharides, and sabina may be used to advantage. The ethereal oils and also oleum sabinæ cause headache when long used. The latter lessens the rapidity of the growth of the hair, but increases the average life of the hairs. Balsamic and resinous agents make the hairs less brittle. Care must be taken in adding glycerin to the agents named; with the alcoholic agents and alkalies which themselves make the hair rough, the glycerin increases this effect and is to be avoided. When the scalp is very raw and the formation of crusts is marked, salves may be used in place of the solutions or alternating with them. Whether the agents of the last-named group are of any value is questionable. At any rate, besides the use of these the hair must be rationally taken care of, as was stated in the beginning of this section.

From what has been said, it will be understood that the following prescriptions are not all equally efficacious in increasing the growth of the hair.

℞ Sodii bicarb., ... ʒ iij.
Ungt. emoll., ... ℥ iss.
M. S. Salve (Pincus).

℞ Sodii bicarb., ... ʒ ss.– ʒ i.
Aq. destil., ... ℥ vi.
M. S. Hair water (Pincus).

℞ Cort. quinin reg., ... ℥ iij.
Digere c.
Spir. vini rect., ... ℥ iiiss.
p. 8 dies; filtra; dein adde
Spir. saccharat opt., ... ℥ ij.
Ol. nith., ... q. s. ad odor.

M. S. Spiritus of quinine for the hair. After removing the fat from the scalp with soaps or alkalies, this is to be rubbed in energetically three or four times. The head should not be dried afterward.

℞ Ext. quin. frigr. parat., ... 3 iij.
Quinae muriat., ... 3 i.
Vini rubri optimi, ... ℥ ss.
Aquae ad remanent., ... ℥ i.
Ol. rosm., ... 3 iij.
Tinct. malat. ferri, ... 3 ss.
Tinct. myrrhae, ... 3 i.
Tinct. rosae, ... ℥ iss.
M. ventriculo. S. Hair pomade.

℞ Ol. maydis,
Ol. terebinth.,
Ol. amygd., ... āā ℥ ss.
M. S. Hair oil (for alopecia areata).

℞ Tinct. formic., ... ℥ ij.
Quiniae sulph., ... gr. xvi.
Aq. colonien., ... ℥ i.
M. S. Spirits for the hair.

℞ Quin. sulph., ... gr. xvi.
Acid. acet.,
Acid. carbol., ... āā ♏ viij.
Mixt. oleos. bals., ... 3 vi.
Glycerini, ... ℥ i.
Ol. ricini, ... ℥ iiiss.
M. S. Liquor trichopathicus (Hager).

℞ Tinct. quiniae, ... 3 vi.
Ol. sabinae, ... gtt. x.
Spir. vini gall., ... ℥ iss.
M. S. Spirits for the hair.

℞ Tinct. gallar.,. . . . . ʒ iij.
Tinct. cantharid., ... ʒ ss.
Aq. coloniens., ... ℥ i.
M. S. Spirits for the hair.

℞ Acid. tannici, ... gr. xvi.–ʒ i.
Spir. vini rect., ... q. s. ad solut.
Ol. amygd., ... ℥ iss.
M. S. Hair oil.

℞ Tinct. capsici, ... ℥ ss.
Aq. coloniens., ... ℥ iiss.
M. S. Spirits for the hair (for alopecia areata).

℞ Tinct. hellebori albi, ... ʒ i.
" benzoini, ... ℥ iss.
" myrrh., ... ℥ ss.
Spir. vini gall., ... ℥ viij.
M. S. Spirits for the hair.

℞ Bals. peruv., ... ʒ ss.
Ungt. pomadin., ... ℥ iij.
M. S. Hair pomade (Hebra).

℞ Tinct. hellebori,
Tinct. canthar., ... ää ♁ij.
Spir. vini rect., ... ℥ viij.
M. S. Spirits for the hair.

℞ Veratrin., ... gr. ij.–viij.
Spir. vini gall., ... ℥ iv.
Spir. lavandul.,
Glycerini, ... ää ʒ vi.
M. S. Spirits for the hair.

℞ Sol. hydrarg. bichlor. (gr. viij. ad ℥ v.),
Glycerini,
Spir. colon., ... ää ℥ iss.
M. S. For washing the head.

℞ Ol. sabinæ, ... gtt. xv.
Spir. vini rect., ... ℥ iss.
M. S. Spirits for the hair (Pincus).

℞ Acid. salicyl., ... ʒ ss.
Tinct. benzoini, ... ☉ ij.
Ol. ped. tauri, ... ad ℥ iiiss.
M. S. To be rubbed into the scalp after the fat has been removed.

℞ Inf. frond. sabinæ, ... ʒ iij. : ℥ iiiss.
Ext. quiniæ frig. parat., . . . ʒ i.
M. S. Hair water.

℞ Acid. carbol., ... ♏ xvi.
Sulph. sublim., ... ʒ i.
Adip. colli equini, ... ad ℥ iss.
Ol. bergam., ... gtt. x.
M. S. Hair pomade (Lassar).

℞ Pilocarpin. mur., ... ʒ ss.
Quin. muriat., ... ʒ i.
Sulph. præc., ... ʒ iij.
Bals. peruviani, ... ʒ vi.
Medull. bovin., ... ad ℥ iiiss.
M. S. Hair pomade (Lassar).

The treatment of the falling out of the hair is tedious and requires care and patience both on the part of the physician and on the part of the patient. It must be methodically carried out, and every agent used must be carefully applied. If any result at all is to be obtained, it is only through the alternation and combined employment of the various agents.

It is best to divide the treatment into three periods. In the first the scalp is completely freed from grease, from crusts and scales, by the use of soap, spiritus saponatus kalini or alkaline solutions with or without the previous use of fats, according to circumstances. To wash the scalp with alkaline or alcoholic solutions, the hair is parted at different points with a coarse comb (démêloir) and the fluid rubbed in for some moments with a shaving-brush. The evening is preferable for this. After the washing with soap the hair is to be washed with a shower-bath, first with warm, then with cooler, and finally cold water. It should be then dried and left for an hour. The soap treatment may be completed in one or two days; the alkaline treatment is continued two or three times a week for several weeks. Following this comes the treatment

with irritant, tonic, astringent, or specific agents, that is to say, with the agents for increasing the growth of hair in general. In simple or premature alopecia, these should be applied from once to three times a week with a soft brush or sponge; in alopecia areata they are to be rubbed in energetically with a stiff brush and left to dry.

Salves may be rubbed in either with a stiff brush or with the finger. Quinine and tannin preparations must always be energetically rubbed in. After the application of alcoholic or aqueous solutions of irritating substances, fat inunctions should be made, either with simple oil and pomade or with preparations to which medicaments such as acidum salicylicum have been added. Such inunctions may also at times be necessary in the course of irritant treatment, when the scalp becomes rough, raw, and red. During such treatment and also during the fat treatment, soap washings are to be employed once or twice a week.

Hair Dyes.

Only the free part of the hair outside the follicle can be dyed. In the ordinary methods the color affects for the most part only the epithelial layer of the hair. In rarer cases in which a coloring matter has been a considerable time in contact with the hair, a staining of the cortical substances occurs by imbibition. It is impossible to dye the hair from the root outward in any manner. The color becomes less intense after some time on account of the washing, combing, and brushing of the hair. For this reason and because of the new growth of gray hair the dyeing process must be repeated from time to time. As a rule, only gray or red hair is dyed. The requisites of a good dye are that it should be easy to apply, that the color should be natural, should appear quickly and should be durable, and that it should contain no injurious substances. It is difficult to fulfil all these requirements, and it cannot be said that any one of the agents used does this. The most natural coloring is obtained by the use of black dyes, although it is out of the question to try to get the peculiar tone of bluish-black hair. The middle colors, light brown and blond, are much less natural; growing hair is never dyed white. Most agents cause a rapid coloring, yet many persons,

in order to make the deception as great as possible, prefer a gradual dyeing; this is only undertaken with dark or semi-dark hair. A weak, gradually-appearing dark color is obtained by using hair oils and certain animal fats, which contain a small quantity of sulphur or iron, such as freshly extracted oil of eggs and neat's-foot oil. It is commonly believed that the former, if used soon enough, will prevent grayness. Other agents which form colored combinations with the acids of the atmosphere or the sulphur of the hair, such as extract of nut hulls, tannin, acidum pyrogallicum, and many metals, especially in pomades or hair oils, cause a gradual darkening of the hair. Dilute acids when long employed make the hair lighter. Mothers who wish to keep their children blond avoid the use of oil and wash their heads with vinegar, lemon juice, or camomile tea.

No artificial hair dye is permanent in its effects in the sense which the laity believe, since the color gets weaker as time elapses and the new growing hair, which has another color, must be dyed in its turn. The conditions being the same, the dyeing with henna, lead, silver, and other metals is the most permanent.

The vegetable and organic dyes are generally innocent; next to these are iron and potassii permanganas; then copper, bismuth, and potassii bichromas; next peroxide of hydrogen, silver, and finally lead. The bad effects are either local, causing the destruction of the hair or skin, inflammation of the eye, and nasal catarrh, or general, as in the case of lead, which used in the form of cosmetics or dyes may produce a severe intoxication. The local affections are produced by the organic and metallic agents as well as by the agents later to be mentioned.

The organic and vegetable hair-dyeing agents commonly used are as follows:

1. Fresh walnut hulls. The fresh juice and the fresh parenchyma of the hulls or of the unripe nuts, color light or gray hair gradually dark brown. The coloring substance is not known, but is probably a phloroglucide; it is extracted by means of fats and alcohol, but is not active in these solutions.

2. Henna. The leaves of the Lawsonia inermis contain a material belonging to the phloroglucides and soluble in water, which stains the epidermis, especially the horny portion,

orange-red; the color may be made darker by the use of alkalies, and may be removed, though only with difficulty, by means of acids. All hair, even the naturally dark, is colored red by henna. In order to get the black color desired, the hair, after being colored red by henna, must be treated with indigo. The color so obtained is a beautiful black.

The process is as follows: After the fat is removed from the hair by means of soap, single strands of it are smeared with a paste made of henna powder and warm water. The hair is then left for an hour, after which time it is washed with warm water. Ater being dried, it is smeared in a similar manner with a paste prepared from indigo powder and water, which after an hour is washed off. The hair which was colored orange-red by the henna appears at this stage greenish-black, and later, through the oxidation of the indigo, it becomes intensely bluish-black. This dye is very permanent; it is months before the hair requires redyeing. According to J. E. Polak, to whom we owe the description of the dyeing methods used in Persia, by the application of a paste consisting of one part henna and three parts indigo with water, the hair can be colored any shade from light to dark chestnut-brown by varying the length of the period of application. One hour is sufficient for light brown, an hour and a half is required for dark brown. According to my experiments, which were made only on dead gray hair, the tints obtained are not black, but more or less brown, having no likeness to a natural color of the hair.

Neither of these powders is injurious; according to the Persians they even increase the growth of the hair. Henna is a drug which was employed as a medicinal agent in the earliest times, being used as an application for headache, etc. It is not difficult to get; it may be had in quantities, as I have convinced myself, in the Egyptian bazaar in Constantinople, at a fairly reasonable price. Both powders, when dried and protected from the air and light, are very permanent. I have obtained an excellent dye with preparations twenty years old. This is especially true of henna, which becomes red under the influence of light—it is originally yellowish-green—without losing its coloring power. Indigo is readily injured by moisture, and Polak recommends in place of it a mixture consisting of—

Indigo,	
Grape sugar,	
Pease-flour, ...	āā gr. viij.
Aqua, ...	℥ ij.

Add yeast and put the mixture in a warm place. When it effervesces, the hair, previously colored with henna, may be brushed with this mixture and in this way a similar color be obtained. It is not possible to produce a blond color of the hair by henna alone, as Alpinus thought; the hair becomes orange-red, which possibly might be made paler by treating it with an acid.

The scalp may be also colored red with henna, but since this occurs only after intense and long-continued application, it may easily be avoided. The women of the Orient, with a taste quite incomprehensible to us, color their nails and finger-tips and even the whole palms of the hands with henna. The manes and tails of the Turkish and Bosnian horses are also dyed red with henna.

The process requires at least half a day. It should be stated that in case the hair is not redyed, the color gradually disappears and the most incredible tones appear, such as bluish-violet, wine-red, etc. If the dyeing be not continued up to old age, the individual must remain concealed for weeks or only appear with the head covered.

3. An agent which colors the hair in a worse manner than henna alone is curcuma, an alcoholic tincture of which colors the hair at once pale yellow. The coloring matter of curcuma is turned brown by alkalies, for which reason the hair is to be washed with soda after the fat is removed. The yellow color is not that of a natural blonde, and curcuma is used only in the theatre or in subdued lights. It is used, as James says, by individuals who wish to escape recognition. The color can be removed again by simple washing.

4. While treating of cosmetics a very simple and uninjurious agent was mentioned which is used to darken the eyebrows. This is lampblack, which is prepared as a cerate with wax and fats, or used as India ink, which is in reality nothing but lampblack suspended with mucilage in rose water. The latter preparation is sold as kohol (Piesse), teinture Chinoise. Under this name kohol a finely-powdered antimonii sulphidum

is used for blacking the brows and lashes by Egyptians of high and low condition. The use of this goes back to the most ancient times. An effect similar to that of the French kohol is gotten by a number of agents, which are dark-colored alkaline extracts of peat, etc.

5. Acidum pyrogallicum is one of the organic agents which is used alone and in combination with metallic substances or alkalies. The hair moistened with solutions of acidum pyrogallicum and the epidermis as well become dark gray or black under the influence of air and light. The color so obtained is not pleasing, and appears only in the course of some days or possibly weeks. With alkalies it causes a brownish-black color. The color obtained by the use of acidum pyrogallicum alone may be fixed with alkalies, and is then removed with difficulty by water, but easily removed by dilute acids, vinegar, or lemon juice. It is much more frequently employed in combination with metals.

Inorganic Dyes.

1. Iron. Various combinations of this agent are employed, and even its internal use has been recommended for premature grayness. Soluble salts of iron alone make the hair darker by forming ferri sulphidum, but usually a second substance is added which is either sulphur or an agent like tannin or acidum pyrogallicum, which form dark-colored combinations with iron. Pfaff recommended a pomade composed of oil of egg which contains sulphur, and ferri lactas; Eble gave ferri acetas with balsam sulphuris. Besides these, dyes are used which contain a salt of iron and tinctura gallarum or a solution of acidum pyrogallicum. Any salt of iron may be used. A combination of ferri sulphas and acidum pyrogallicum may be recommended as simple and harmless; the same may be said of mixtures containing salts of iron and copper. Here belongs also a Turkish hair dye. For its production, pounded galls are roasted with oil by which acidum pyrogallicum is produced; the mass so obtained is pulverized and kneaded with water to a paste and dried over a fire. To this is added a powdered mixture of the oxides of copper and iron, rasticopetra or rastik-yuzi; the paste is to be kept in a moist place, and small quantities of it rubbed into the hair with the

fingers. The paste is often mixed with perfumed powders. The color of the hair becomes a permanent and glossy black. Stains on the skin from ink made with galls may be removed by acids.

2. Manganese. A solution of potassii permanganas is reduced by organic substances and forms a hyperoxide of manganese. Hair and skin are colored an intense brown by a concentrated solution of this salt. The color is, however, not permanent and must be frequently renewed. It is more permanent when the hair has been previously moistened with a solution of hyposulphuret of soda. When dead hair is treated with a concentrated solution of potassii permanganas and afterward with warm concentrated acidum oxalicum, it loses its color and becomes white. This decoloration does not take place in living hair, as I have demonstrated on myself. Stains produced by manganese may be removed by washing them in dilute acids.

3. Copper. Salts of copper form dark brown combinations with various substances. Such substances are the solution of potassii ferrocyanidum, sulphur in the form of the sulphydrate of potassium or calcium, and acidum pyrogallicum. Of the salts of copper, cupri sulphas dissolved in ammonia is most frequently employed, or, more rarely, cupri chloridum.

The brown stains on the skin may be removed by the solution of potassii cyanidum. The hair is dyed a fine brown by these salts; agents which color the hair black have often added to them salts of copper, and the black then produced is not of an inky tone, but brownish. Other substances, such as iron or nickel, are added to the copper solutions to make these dye more darkly.

4. Lead. All the salts of lead turn black from the action of the hydrogen sulphide of the atmosphere, which forms plumbi sulphidum. Even the repeated combing of the hair with a lead comb makes it darker; but the action of so small a quantity of lead is slight. The action of all the salts of lead is slow; if sulphur præcipitatum be added the process is hastened; immediate coloring is only obtained, however, when the hair, after being treated with the lead preparation, is exposed to hydrogen sulphide, calcii sulphidum, etc. The preparations most employed are composed of litharge mixed with calx viva, sodii sulphydras, or plumbi oxyhydras in alkaline solution;

plumbi acetas with calcii carbonas and calx viva, sulphur, sodii hyposulphis, and salts of silver and bismuth; plumbi nitras, chloridum, hyposulphis, and carbonas. The lead salts are used almost exclusively for coloring the hair brown or black. On account of their poisonous action, their sale is forbidden by law in Germany and Austria.

5. Silver. Argenti nitras in the presence of organic substances and under the influence of light is reduced; black metallic silver separates in the form of granules. This reduction is produced much more quickly by acidum pyrogallicum.

With hydrogen sulphide, the silver salts give a black precipitate of argenti sulphidum. Epidermis and hair become brown or brownish-black after being simply wet with silver solutions. The color appears more quickly when the hair is treated previously with acidum pyrogallicum or afterward with sulphydrate of sodium or potassium. The color obtained by argenti nitras is very permanent; if the hair goes for a long time without redyeing, it takes on a greenish, then a reddish tone. This occurs also when the fat has not been entirely removed from the hair before the application of the dye. By using an ammoniacal mixture of argenti chloridum and cupri sulphas, and with this sodii sulphydras, a bright reddish blonde color is obtained. Argenti nitricum is applied in solution with ammonia. The less ammonia there is present, the darker will be the color obtained. Stains on the skin may be removed by potassii cyanidum, saturated solution of potassii iodidum, or potassii ferrocyanidum.

6. Cadmium. The salts of cadmium form yellow compounds with sulphur. If the hair be moistened with cadmii sulphas and then treated with ammoniæ sulphas in solution, it takes on a yellow or blonde color. If the cadmium predominate, the color is darker; if more ammonia be added, the color is lighter. The skin is also colored yellow; the stains may be removed by acids.

7. Chromium. Acidum chromicum and the neutral and acid potassii chromas are reduced by acidum pyrogallicum. The product is of dark, reddish-brown color. Gray hair may be colored reddish-brown by means of this. Acidum chromicum is very caustic and should be used only in dilute solution; the acid potassii chromas has a similar action. Care must be taken in the employment of salts of chromium, since they are poisonous.

8. Hydrogen peroxidum. Organic substances are bleached by this. Dark or red hair is colored reddish-yellow or blonde by it. The color, or rather the bleaching, does not come on at once, but the agent need be reapplied but rarely. Small spots are made on the skin by this agent. It exists only in aqueous solution which must be fairly concentrated (15 to 20%). The solution retains always some acidum nitricum and decomposes easily when exposed to the air and light, after which it cannot be used. Acidum nitricum alone gives a yellow color to epithelium, which, before hydrogen peroxide came into general use, was strengthened by a solution of acidum picricum, which also gives a yellow color. The yellow obtained in this way is very different from the natural yellow of the hair.

The mineral dyes are given in the form of pomades and hair oils when a gradual dyeing is desired, in other cases in concentrated aqueous solution (5 to 20%). The metallic salts are given together with the coloring substances, such as sodii hyposulphis and sulphur, or without these, as acidum pyrogallicum, tinctura gallarum, sodii sulphydras. This depends partly on the necessity of their separation for producing the color, and partly because certain mixtures, such as that of iron and tannin, produce the color or precipitate in the bottle, and this dye would then have little effect on the hair. Many drugs are added to these mixtures which have no purpose whatsoever. The mordant or precipitating agent is often chosen at will and from time to time replaced by another agent. The different mixtures are usually given in separate bottles. Even when one mixture alone suffices for the production of the color, the necessary mixture for removing the fat is given in a second bottle. A third mixture is often given for removing the stains that the dye leaves on the hands. In prescribing dyes the purpose of each separate bottle should be clearly understood by the patient. From what has been said, the reader may compose the various hair dyes as he wishes, remembering only that the solutions are to be concentrated. A perfume is generally to be avoided.

℞ Acid. pyrogal., ... ℥ xvi.
Spir. vini rect.,
Aq. destil., ... āā ʒ vi.
M. S. Hair dye.

℞ Ferri sulph., ... ʒ ss.
Aq. destil., ... ʒ v.
M. S. No. I.

℞ Acid. pyrogallici, ... ♏ xvi.
Aq. coloniens., ... ℥ iss.
M. S. No. II.

℞ Ol. ovor. rec. press.,
Medull. oss. bov., ... āā ʒ i.
Ferri lactic., ... ʒ ss.
Ol. cassiæ æth., ... ♏ xxiv.
M. S. Pomade (Pfaff).

℞ Cupri sulph., ... gr. xxiv.
Aq. destil., ... ℥ i.
Ammon. p. liq., ... q. s.
ad solut. sedim. enasc.
M. D. in vitr. cœrul. S. No. I.

℞ Potassii ferrocyan., ... ʒ i.
Aq. destil., ... q. s.
ad perf. solut.
M. S. No. II. Or,

℞ Calcii hydrosulph., ... ʒ ss.
Aq. destil., ... ℥ iss.
M. S. No. II. or acidum pyrogal. 1:50.
D. Teinture brune française.

℞ Bismuth. subnitr., ... ʒ ss.
Sodii subsulph., ... ʒ i.
Aq. destil., ... ℥ iss.
M. S. Hair water.

℞ Bismuth. nitr., ... ʒ i.
Ærugin., ... gr. xvi.
Ol. amygd., ... q. s.
ut f. ter. mass. tenerr.
Ungt. emoll., ... ℥ i.
M. S. Hair pomade (Neumann).

℞ Sodii hydrosulph., ... ʒ ss.
Aq. destil., ... ℥ iss.
M. S. No. I.

℞ Potassii hypermang., ... gr. xvi.
Aq. destil., ... ℥ iss.
M. S. No. II.

℞ Potassii oxalati, ... ʒ ss.
Aq. destil., ... ℥ iss.
M. S. No. III. For removing stains caused by the preceding.

℞ Argenti nitr., ... ʒ ss.
Aq. destil., ... ʒ vi.
D. in vitr. cœrul. S. No. I.

℞ Potassii sulph., ... ʒ ij.
Aq. destil., ... ʒ vi.
M. S. No. II.

℞ Potassii cyanati, ... ʒ ss.
Aq. destil., ... ʒ vi.
M. S. No. III. For removing stains—poison!

℞ Acid. pyrogal., ... gr. xvi.
Aq. destil., ... ℥ ij.
M. S. No. I.

℞ Argenti nitr., ... ʒ ss.
Aq. destil., ... ℥ ss.
Ammon. p. liq., ... q. s.
ad solut. enasc. sedim.
D. in vitr. cœrul. S. No. II.

℞ Potassii iodidi, ... ℥ ss.
Aq. destil., ... ℥ i.
M. S. No. III. For removing stains.

℞ Argenti nitr.,
Tartari depur., ... āā gr. xvi.
Ammon. p. liq., ... ʒ ss.
Ungt. rosæ, ... ℥ i.
M. S. Hair pomade.

℞ Cadmii sulphat., ... gr. xvi.
Aq. destil., ... ʒ ss.
M. S. No. I.

℞ Solut. ammon. hydrosulphurati, . . ℥ iss.
M. S. No. II. Teinture blonde américaine.

℞ Potassii bichrom., ... ʒ ss.
Aq. destil., ... ʒ vi.
M. S. No. I. As No. II. use acidum pyrogal. as above.

℞ Solut. hydrogen. superoxid., 10–20%, . . ʒ iss.
M. S. Hair water.

The application of the hair dyes is very simple. When pomades or preparations of lead are employed—which latter, however, should not be used—the preceding removal of the fat may be dispensed with. In the latter case the fat should be left, for the reason that the sulphur of the fat causes the formation of plumbi sulphidum and thus the color. In all other cases, the hair is to be cleaned by means of a sponge or a soft shaving-brush with a solution of soap 1 to 2%, or soda or ammonia solution 1 to 2%, and afterward washed with warm water. The hair should then be carefully and quickly dried by fanning and combed with a coarse comb. The color is made better and more uniform by the thorough drying. This procedure need not be so carefully gone thorough with, especially with the alkaline sulphides. The solution of the metallic salts may be rubbed into single strands of the hair from the point toward the root by means of a soft tooth-brush. The thoroughly dried hair is then treated with the fixative agent, the mordant. The hair is then left to dry, and afterward combed regularly to obtain a mixture of the various shades, and finally greased to give it a gloss. In dyeing the beard and the hair when it is short, it must be thoroughly washed with water in order to remove the excess of the coloring or fixing agent. The hair should be redyed every eight or ten weeks, the beard and the mustache every four weeks at least. Most dyes produce stains on the skin and linen which are hard to remove. In order to avoid these it is well to put a rubber or oil-cloth covering about the shoulders, to wear gloves, and to oil the face with glycerin or fat.

Of the injurious effects which I have myself observed, I would mention pustular eczema following the use of ammoniated cupri oxidum and acidum nitricum. In one case I have seen severe herpes conjunctivæ appear at each dyeing of the hair with argenti nitricum in a man of sixty, and disappear when the use of the agents was stopped or when it was replaced by potassii chromas.

Depilatories.

It is easier to destroy the hair than to replace it, and while we possess but few agents which increase its growth, we have a number of excellent agents for removing it.

These act either mechanically or chemically. The mechanical procedures, apart from shaving, singeing, and rubbing with pumice-stone, are barbaric. These are the tearing out of the hair by means of tightly-sticking plaster and the extraction by means of broad-jawed forceps. Of shaving it need only be said that the soap used beforehand has a chemical action in softening and swelling the hairs by means of the alkali which it contains. Singeing, practised in ancient times by means of nut shells, is still employed to-day on parts of the skin which are not very sensitive and which are covered with coarse hairs; for example, the calves are singed with a candle flame. Rubbing with pumice-stone is not done in our day. The application of tightly-sticking plasters which tear out many of the hairs in their removal is very painful. The extraction by means of the forceps is still more painful, and on this account can only be repeated at long intervals. The two last methods have the disadvantage that not all the hairs can be removed at one sitting.

This is easily obtained by using chemical agents. At the present time sodii sulphydras, calcii sulphydras, and arsenici sulphidum are used for this purpose. Potassii sulphidum is seldom used because of its severe action on the skin, barii sulphidum seldom because of its weak action.

Sodii sulphydras is a salt readily soluble in water, which is obtained by passing sulphuretted hydrogen into soda lye.

Calcii sulphydras is insoluble in water, and is obtained by passing sulphuretted hydrogen into a preparation of freshly-slaked lime. It is a greenish jelly-like mass. For a similar purpose other combinations of sulphur and lime may be used, such as the solutio Vlemingkx and sulphuret of potassium with lime. The latter has a weak action and only gives perceptible results when mixed with slaked lime, while the solutio Vlemingkx irritates the skin severely and produces often a dermatitis.

Orpiment is a combination of sulphur and arsenic found in nature which, mixed with caustic lime, is used as a depilatory.

The action of the alkaline sulphides and of the calcii sulphidum on epithelium is about the same as that of the caustic alkalies. If hair, epidermis scales, or the like be treated with alkaline sulphides or with solutio Vlemingkx, they turn in a short time into a soft gelatinous mass and partially lose their color. If these be applied to the living hair the effect is the same, and the partially-destroyed hair may be easily brushed off. The skin may also become swollen if the application be long continued, and after the removal of the agent, appear dry, rough, and inflamed. In the use of arsenici sulphidum, the chief part of the action is due to the calcii sulphidum, since arsenici sulphidum is always mixed with caustic lime. As the arsenici sulphidum contains always acid combinations with arsenic, the action is also partly due to these, since they may cauterize the surface of the hair follicle. The inflammatory irritation and cauterization of the interior of the follicle, which is caused in less degree by other chemically acting depilatories, may occasionally cause a complete cure by destroying the follicle.

The alkaline sulphides and the calcii sulphidum are suspended in water, or mixed to a paste with starch or lime water; orpiment is made into a similar paste with lime water or albumen. The manner of their application will be seen in the following prescriptions:

℞ Sodii hydr. sulph., ... ℥ iv.
Solv. in aq. calc., ... ℥ x.
Calc. hydr. pulv., ... ℥ iiiss.
Misce, dein sensim adde
Amyli, ... ℥ i.
M. f. pasta.

℞ Solut. concentr. barii sulphurat., . . ℥ iiiss.
Amyli, ... q. s.
ut f. pasta (Redwood).

It is to be prepared extempore, since the agent readily decomposes.

℞ Calc. caust. pulv., ... ʒ iij.
Sodii hydr. sulph., ... ℈ ij.
Amyli, ... ʒ iij.
M. f. p. Some of this powder is to be rubbed to a thin paste (Boudet).

℞ Barii sulphid., ... ʒ iij.
Zinci oxid.,
Amyl., ... āā ℥ ss.
M. S. To be mixed with water to a paste.

℞ Calc. hydr. sulph. in aqua, . . . ʒ vi.
Ungt. glycerini,
Amyli, ... āā ʒ ij.
Essent. citr., ... gtt. x.
M. S. To be spread one line thick on the parts from which the hair is to be removed, and after ten to thirty minutes washed off (Reveil, Martius, Boettger).

℞ Sodii hydr. sulph., ... ʒ iij.
Cret. præp., ... ℥ i.
Aq., ... q. s.
ut f. pasta.
S. To be spread on as thick as a knife-blade and washed off after some minutes.

℞ Calc. hydrat., ... ℥ i.
Orpiment pulv., ... ʒ i.
M. exact. S. To be mixed with water to a thin paste (Rhusma).

℞ Calc. hydrat., ... ℥ iss.
Orpiment, ... ʒ iij.
Amyli, ... ℥ i.
Aq. calc., ... q. s.
ut f. pasta mollis.
S. Paste (Neumann).

℞ Calc. caust. pulv., ... ℥ i.
Pulv. irid., ... ℥ ij.
Orpiment, ... ʒ i.
M. S. Like the preceding (Débay).

℞ Calc. viv., ... ℥ i.
Gumm. pulv., ... ℥ ij.
Orpiment, ... ʒ i.
M. S. Like the preceding (Delacroix).

℞ Calc. ust., ... ℥ ij.
Orpiment, ... gr. xvi.
Liq. potassii caust.,
Album. ovor., ... q. s.
ut f. pasta mollis.
M. S. Dépilatoire (Débay).

℞ Orpiment, ... ℥ ss.
Calc. viv., ... ℥ i.
Coque c.
Liq. potas. caust., ... ℥ xvi.
M. S. Depilatory water (Débay).

℞ Orpiment, ... gr. xvi.
Amyli, ... ℥ iij.
Calc. vivæ, ... ℥ ss.
M. S. As above.

℞ Orpiment, ... ℥ iiss.
Sodii hydrosulph., ... ℥ iss.
Coque c. Aq., ... q. s.
Calc. hydrat., ... q. s.
ut f. pasta mollis.
M. S. Paste.

The preparation as well as the application of the remedies employed as depilatories is very simple. These agents are mostly used in the form of soft pastes, which are either to be prepared by the apothecary or made into a fine powder, which immediately before using is to be mixed in water or other fluids, such as potash lye, into a paste. They need seldom be boiled. The alkaline sulphides, as well as the calcii sulphidum, have an unpleasant odor of sulphuretted hydrogen. This odor is hard to remove, and when a perfume is added, the resultant odor is even worse than the original one. However, if a penetrating odor be desired, essent. citri may be used. The mixture with iris flor. given above is not unpleasant.

The indications for use vary with the different authors and the different preparations. The pastes are applied in a layer as thick as a knife-blade. The waters are applied until the parts are quite wet. The length of time for the application of the alkalies of sulphur, barium, and calcium is from ten to thirty minutes; for orpiment, two to five minutes. Many of

the pastes, such as the rhusma, are left until dry. The best indication is the feeling of the patient; as soon as the slight itching which the application causes gives place to an intense burning, the remedy is to be stopped; if the remedy be applied too long the skin becomes inflamed, and since it is robbed of its epidermis in places, it appears spotted. After the application, the paste and the softened hair are removed together by means of a dull knife, a paper-knife, or spatula of ivory, bone, or horn. The skin is then to be carefully washed with warm water, and since tender portions of the skin are always reddened and inflamed by the procedure, inunctions of almond oil, cold cream, or zinc salves should be made after the skin has been thoroughly dried with cotton wool. When the hair is dark, powder is to be applied after the inunction.

The selection of the agent depends on the locality from which the hair is to be removed, on the sensibility of the skin, and on the quality of the hair. Boettger's depilatorium is indicated for the face, and in females, when soft, light hair is to be removed, since this remedy irritates least and acts so energetically that its application need not be repeated for months. The most severe in its action is orpiment with lime, whether in paste or in decoction. The latter must be so strong that when a feather is dipped into it the vanes fall off. This agent, if used at all, should be applied only to the less sensitive parts, such as the arms and the lower portion of the thigh, and where the hairs are coarse, as in the beard.

All these depilatories are only palliative in their action; the hair grows again after a longer or shorter time, and only after repeated application of the remedy is atrophy of the follicle produced, and thus complete healing secured. This is only to be gotten with certainty by means of electrolysis.

III. The Nails.

The nails are spheroidal quadrilateral plates, shield-formed, and convex upward, which rest on the terminal phalanges of the fingers and toes. They are made up of horny epidermis cells, in the superficial layers overlapping each other like tiles. The nail is implanted on three of its sides into a groove in the skin, and projects, with its anterior border, beyond the finger-tip. The portion of the finger on which the nail rests is called

the bed of the nail. The portion of this bed further back beneath the root of the nail is called the matrix. The body of the nail is separated from the root by the lunula, a curved line parallel to the outline of the finger-tip, beneath which the root of the nail appears of a rose or milky white color, sharply cut off from the red of the body of the nail. The white color is caused by the slighter transparency of this part of the nail, which latter depends upon the unusual thickness of the root and upon the regular arrangement of the cells in the mucous layer at this point (Toldt). The lunula is the boundary between the part of the matrix having large papillæ and the part toward the free edge of the nail with smaller papillæ. According to H. Hebra, only the lateral and posterior portion of the matrix deserves this name, since it alone has large papillæ and may be regarded as concerned in the production of the nail. The nail becomes gradually thicker from its posterior boundary up to the lunula; from this it continues forward uniformly thick. The bed of the nail is richly supplied with vessels and nerves. The under surface of the groove is covered with epidermis which extends somewhat over the surface of the nail.

The nails grow from behind forward, faster in summer than in winter; in the course of a year about half a drachm of nail substance is produced. The growth is slow, and several weeks are required for the nail to be completely replaced. If a nail be cut it grows rapidly, but beyond a certain length it does not grow.

The cells of the nail substance are chemically like other horny epidermis cells; they swell up in lye. They are in general very resistant to chemical processes, but are easily stained by certain agents. These stains can only be removed with difficulty. If the nails become unusually dry they get brittle; if they take up water, as in bathing, in sucking the fingers, or in excessive sweat secretion of the toes, they become soft.

The beauty of the nail lies in its color, its curve, and its length. The body of the nail should be smooth, glossy, and translucent, and should show a regular white crescent posteriorly. Children from one black and one white parent show a reddish-brown pigmentation of the lunula, and even in quadroons this peculiarity throws light on the color of the progenitors. The free margin of the nail should be smooth, para-

bolic, and extend as far as the finger pulp itself, to which it should serve as a protector. If the nails are kept too short, as in pianists or when the individual has the habit of biting the nails, the finger-tips become broad and flat. If they are worn too long they break off easily. The Chinese custom of wearing the nails long, signifying that the individual has nothing to do, is inconvenient and ugly. The groove and the thick cutis should be regular as well as the epidermis covering the root of the nail, which latter should not extend too far outward on the nail. Very beautiful finger-nails are much rarer than beautiful hands: they are usually ruined by the use of cosmetics. While the present methods of covering the feet remain in use, no beauty can be expected in the toe-nails. If the nails are not beautiful by nature, they may at least be kept clean and pure.

The cosmetic treatment of the healthy nails is a proper hygienic care of them. The cutting is best done with blunt scissors curved on the flat. The edges at the sides are not to be cut in too deeply, since in the first place it looks ugly and in the second it permits the growing-in of the nail.

For this reason and since experience teaches that the nail cut on the sides grows fastest, the nail of the great toe should be cut squarely across or concavely, differing thus from the other nails, which should be cut in a parabolic line. If the cut surface be not altogether smooth, it should be made so with a file.

In the space under the nail in the hands of persons who do nothing, even in those who wear gloves the whole day, and of course much more in laborers, a yellow-gray or black dirt collects, composed of epidermis scales, dust, fat, etc. The removal of this dirt is a consideration of beauty, of cleanliness, and of hygiene in many cases, such as in the finger-nails of physicians. If the cleaning be not too long delayed, soap and water applied with a brush will accomplish it except in the case of blood.

At times the dirt must first be removed with a blunt-pointed instrument. The common nail-files of steel or ivory are not good, since they often wound the epidermis lying under the free margin of the nail. A blunt-pointed flexible stick is the best. After the nail has been cut, cleaned, and washed, the epidermis should be pushed back on the root of the nail by

means of the spatula and of the nail-file. The ordinary steel nail-files are bad here also, since they often cut and tear the epidermis.

An ivory spatula or the finger-nail is better adapted for this procedure. Various agents are recommended to make the nails smooth, rosy, and glossy. The simplest method is rubbing the nail with lemon juice, vinegar, or dilute mineral acids. All these, and especially the lemon juice, have the effect desired; it should, however, be remarked that these agents dry the surrounding skin, wrinkle it, and produce erosions, etc. Besides these are employed the softening agents used for the hands, mostly in the form of pastes, such as almond and honey pastes.

A prescription for these would be

℞ Farin. amygd. decort., ... ʒ i.
Mellis rosati, ... q. s.
ut f. pasta mollis.

The direct polishing agents are emery, a fine granular form of corundum, cinnabar, and oxide of tin powder, varying according to the method of its manufacture from a white granular, amorphous powder to a crystalline or a brownish-yellow amorphous powder. The use of emery as a polishing agent is well known; oxide of tin is used for polishing tortoise-shell or even marble. The two former are used in the form of pastes, the oxide of tin as a powder. The white oxide of tin often scratches the nail in place of polishing it. Since this depends upon the coarseness of the powder, it should be previously sifted. If very tender nails are scratched by the white or the yellow powdered oxide of tin, this may be mixed with twenty to thirty per cent of talc. venet. I prefer the yellow oxide of tin.

℞ Lapid. smiridis pulv.,
Cinnabar factit. subt. pulv., . . . ää 3 iij.
Ol. amygd. dulc.,
Ol. adorat., ... ää q. s.
ut f. pasta mollis (Tromsdorff, 1804).

S. The nails are to be covered with this paste after washing before going to bed, and it is to be rubbed off in the morning with doeskin and almond paste.

℞ Stanni oxidati lævigati, ... 3 iij.
Essent. lavandul.,
Carmino tinct., ... q. s. ad. odorat.

M. S. After washing, the nail is to be rubbed with this powder by means of the fingers, doeskin, or a polissoir. The latter is a bit of wood, ivory, or the like covered with leather.

The nails become diseased in various ways. They are affected in consequence of a number of general diseases, syphilis, scrofulosis, etc.; and after skin diseases like psoriasis, eczema, lichen ruber, etc. Besides this, abnormalities in size, thickness, and color are found which come within our scope.

A beautiful rose color of the nails (*ῥοδοδάκτυλος Ἠώς*—rosy-fingered dawn) is rare. New-grown nails after a trauma are often cheesy-white or brown; with the change in color the gloss disappears. I have seen cases where all the nails, without any apparent disease, became reddish-brown and furrowed longitudinally, and this appearance was permanent. In such cases all treatment is useless. A new-growing nail is often helped wonderfully by covering it with white wax. Subungual hemorrhages, which often occur from pressure and punctured wounds, need no special treatment. The bluish-black spot extends forward with the growing nail and is cut off with the nail when it reaches the free margin.

White spots are often found in the body of the nail; these probably owe their existence to an anomalous secretion of the corium. They vary from the size of a pin-point to that of a poppy-seed. Often, however, a number of these spots coalesce and form a figure of irregular outline. I am not able to say what causes them; they appear at times periodically, often on all the finger-nails, sometimes only on a single nail. These spots also extend forward as the nail grows, and are finally cut off. Various remedies have been recommended for their removal, as for example:

℞ Picis,
Terebinth., ... āā ʒ ss.
Sal. culin.,
Potassii sulph., ... āā ʒ ij.
Aceti, ... ʒ iiss.

M. S. The nail is to be covered with this.

As far as I know, all remedies are useless in this condition.

An important anomaly which concerns as well the size as the shape of the nail is the hypertrophy called onychia, onychographosis, onychauxesis.

We shall not consider here those cases due to general diseases or to affections of the skin, and there remain only those cases in which the hypertrophy is due to a congenital deformity or to trauma. A nail of this sort, if not cut, grows to many times its normal length and is bent once or more times at its end. Often the nail is thin and very brittle, or it may increase in breadth in place of length and many layers of nail substance lie superimposed, so that the nail stands obliquely or almost perpendicularly upward. The layers may also be irregular and the nail thus be bossy, or there may be hollows and longitudinal and transverse furrows. The nail may only increase in its lateral diameter, and in the course of this an inflammation of the bed of the nail, paronychia, come on. In chronic forms the papillæ of the matrix increase also, and when the nail is cut these bleed. These diseases affect more frequently the toe-nails, and chiefly in consequence of trauma caused by improper shoes or in consequence of acquired or congenital twisting of the toes so that one overlies the other. The hypertrophy in breadth affects most frequently the nail of the great toe, which is, therefore, the one most frequently affected with paronychia, ingrowing nail. In the idiopathic diseases of the nails treatment is frequently of service. Gryphotic nails are often cast off spontaneously and the new nail may be sound. Cutting the nail deeply and cauterizing the bleeding papillæ often does good. When the nail is abnormally thick it may be scraped with a bit of glass or filed and then be cauterized, or applications of potash lye or soap made, or the nail be enveloped in emplast. diachyli, hydrarg.

Here belongs also the frequent superficial wounding of the skin in the neighborhood of the groove for the nail. These shallow but often painful splits in the skin, called hangnails, are usually due to improper hygienic measures. When the epidermis is not pushed back for some time, the surrounding skin is stretched and tense, or it tears into little flaps which at one end still adhere to the epidermis. Many individuals are especially disposed to this. These wounds, though slight, may be a source of infection in the hands of physicians and

midwives; careful attention to the nails is the prophylactic treatment.

Ingrown nails deserve a special notice. For the cure of this painful affection surgical procedures have been resorted to, such as the tearing or cutting out of the nail, which are so painful that usually they must be done under narcosis. In place of this, simpler and less painful measures may be used, which, especially in the beginning of the affection, are easily carried out and are followed by good results. The simplest treatment is to introduce charpie bit by bit under the edge of the nail by means of a sound and retain it in position by means of adhesive plaster. This dressing should be renewed daily; the ulcer at the margin heals either by itself or after being cauterized. This latter may be dispensed with and the healing hastened by adding plumbum subnitricum to the charpie. This is a dry powder which has a weak caustic action, producing a dry eschar. Lately, enveloping the nail in tin-foil and raising it from its bed by means of this has been recommended. After it is once cured, care must be taken to cut the nail always square across or slightly concavely.

CHAPTER IV.

THE MOUTH.

THE lips, the teeth, the gums, and in certain cases the cavity of the mouth also require cosmetic consideration.

The lips are two horizontal, very movable folds which surround the fissure of the mouth and on whose margin the external skin passes over into mucous membrane. The red part of the lips, though in reality belonging to the mucous membrane, retains in its outer portion some of the characteristics of the skin; it is dry, with a peculiar gloss, since it contains sebaceous glands, and is covered with an epithelium which is dry from the action of external influences and which, in the normal condition, cannot be seen to exfoliate. The beauty of the lips consists in the outline of the margin, in the regular swelling of their tissue, and in the freshness of their color, as well as in the gloss of the red portion of the lip, which is not visibly moist nor yet altogether dry. The lips are connected with the gums by means of a fold of mucous membrane, the frenulum; a too deep and broad attachment of this band to the upper lip makes the opening of the mouth appear divided into two portions when it is drawn laterally, as in smiling or laughing.

The gum, gingiva, is the mucous membrane inclosing the neck of the teeth. The beauty of the gum depends on its firmness, its regular contour—the pyramids formed between two teeth must not be too prominent and the boundary line of the gum must form a delicate, wavy line; finally on the redness and also on the purity of the gum.

The teeth are hard, bone-like bodies set into the upper and lower jaws, running in the normal condition in a regular curved line. The number is not constant, but on an average perhaps twenty-eight. Three portions of the tooth are recognized, the crown, the most important part from our point of view; the neck, which is inclosed by the gum; and the root,

lying in a corresponding hollow of the jaw. The most important teeth cosmetically are the four incisors, the two canines, and the first bicuspids of either jaw, since these are the ones which usually are visible when the mouth is opened. The other teeth are of importance in another way, since they help to produce the roundness and fulness of the face and the tension of the cheeks. The enamel which covers the crown is of greater interest to us than the dentine or bone of the tooth which forms its proper body, and the cement which covers the outer surface of the root. The hard and brittle enamel covers the crown like a cap, becoming thinner toward the neck and ceasing with a sharp border. The surface of the enamel is covered by a thin, homogeneous, structureless membrane, the enamel skin. The color of the teeth is yellowish-white. To be beautiful, the number of the teeth must be complete; there must be no cavities between the teeth, and they must be normally placed. The individual teeth must not be turned on their axis, but must stand straight. The surface must be smooth, shining, and not partially covered with tartar. Although the normal color should be yellowish-white, a clearer milky-white or a color with a trace of gray is not undesirable.

Finally, the cavity of the mouth should exhibit no stringy saliva when opened, and the breath should be entirely odorless.

The cosmetic errors of the lips are those of color, form, and condition of the epidermis. The lips may be too broad and too much arched, or on the other hand too thin and narrow. Against too broad and too prominent lips (negro lips) the ars fucatrix is powerless. Bad outlines in the lips may, however, be corrected by a line or a point of paint at the angle of the mouth, so that a small mouth will appear larger and a mouth with the corners drawn down may be made to look smiling. In rare cases, bathing the lips with tannin mixtures and other astringents or cerates of this sort will accomplish something. Swelling and too large lips are not a great fault. Small and drawn-in lips which have taken on this form after frequent pinching of the lips together and drawing-in of the mouth, may be improved by frequent sucking and by applications of irritants such as Spanish pepper or mustard. I would recommend, however, neither the one procedure nor the other. The only purpose of the lip paints is to make the lips appear broader, and for this a stroke half a line broad is sufficient.

Colorless, faded lips can scarcely be restored except in cases where this condition is due to severe general disease, and here the natural tendency to convalescence, and the remedies suitable for the general disease may cause an improvement. A favorable prognosis may be made in those cases caused by a transient atony of the muscles and anæmia, while those caused by debilitating diseases and excess in venery are often incurable and require lip paints.

A very important error is the chapping of the lips. In many individuals of either sex the epithelium comes off in larger or smaller scales without an apparent cause. In many cases this is due no doubt to atmospheric influences, in others to the influence of irritants such as tobacco and sharp spices, but besides these there are a number of cases—perhaps the majority—in which no cause can be discovered. The lips are pale and covered with smaller or larger partially-attached scales, or they are red and appear dusty from the presence of the scales; in many places the surface is eroded and suffused with blood, in others covered by a reddish-brown crust. In the middle of the upper and lower lip, more rarely in other positions, the erosions cause deep rhagades which bleed readily and are cured with difficulty. If these last for a long time, as they commonly do, the lips become thick and the cure is more difficult. The duration of the affection when it is caused by external influences is from two to three weeks; in many cases it lasts for months or years, or recurs after being healed, so that a chronic chapping of the lips may be spoken of. In many cases a herpes labialis may be the immediate cause. These rhagades are to be distinguished from the sore spots at the angles of the mouth. These also have a twofold manner of development. The most frequent is by an eczema, which in children especially is moistened by the saliva dribbling from the half-opened mouth, and continuously irritated in this manner leads to excoriations at the exterior angle of the mouth and later to the formation of deep rhagades. In other cases there is first a superficial fissure at the interior angle, which by being torn wider leads, especially when neglected, to the formation of a rhagade.

We should also mention an actual dermatitis, herpes labialis. This is the familiar form of herpes in which one or more groups of vesicles unsymmetrically arranged appear on

the lips, generally with febrile symptoms or accompanying acute febrile diseases. Left to themselves, the vesicles dry in two or three days to a yellowish or reddish brown crust, which falls off several days later; the underlying skin appears normal.

The treatment of chapped lips consists in avoiding the injurious influences mentioned and in the application of one of the cerates or salves given below. The chronically-chapped lips are annoying to both patient and physician. The first precaution is to see that the epithelial flaps are not bitten off, since the tearing so produced leads to excoriations. If these be present, a salve containing acidum salicylicum, or better acidum boricum, should be used. This is not merely to be used at night, but the lips are to be covered with the salve during the day when they are more exposed to atmospheric influences. Lip salves and cerates are to be made only from pure unrancid fats. The use of aqueous or alcoholic fluids is not to be recommended. Glycerin even when diluted is especially harmful; it not only causes pain, but delays the healing. For rhagades a simple covering plaster may be applied by which the edges of the wound are approximated; in many cases, even where syphilis does not exist, mercurial plaster mull has acted very well for me; cauterization with argenti nitras is only occasionally necessary.

The rhagades at the angles of the mouth require merely cleanliness; they may, however, be covered by a protecting plaster or with a pomade.

Herpes labialis also needs no treatment. As long as the vesicles exist a cosmetic powder may be applied. After they dry nothing need be done for them, except to caution the patient against the use of sticking-plaster, which irritates, tears off the crusts, and leads to excoriations.

℞ Ol. amygd., ... ℥ iij.
Digere c.
Rad. alkann., ... ʒ i.
Cola, adde
Ceræ alb., ... ℥ ij.
Spermaceti, ... ʒ iij.
Ol. bergam.,
Ol. citri, ... āā ♐ i.
M. S. Ceratum labiale rubrum (German Pharm.).

℞ Ceræ alb.,
Spermaceti,
Ol. amygd. d., ... āā p. æ.
M. S. Spermaceti cerate (Austrian Pharm.).

℞ Ceræ alb., ... ʒ iij.
Ol. amygd., ... ʒ vi.
Carmini, ... gr. iss.
Ol. rosæ, ... gtt. ij.
M. S. Ceratum rosatum. Pommade pour les lèvres (French Pharm.).

℞ Acid. borici,
Ceræ alb., ... āā ʒ iss.
Spermaceti,
Ol. amygd. c. alkannin tinct., . . āā ʒ iij.
M. S. Boric acid lip pomade.

℞ Ol. rosat., ... ℥ i.
Spermaceti, ... ʒ ij.
Ceræ alb., ... ʒ ij.
Rad. alkann. . . . . ʒ ij.
Ol. rosæ, ... gtt. xv.
M. S. Rose lip pomade (Piesse).

The cosmetic errors of the gums do not depend on general or local diseases. They need be treated of here only in so far as they may be removed by hygienic care, which is at the same time the best cosmetic. The laxness of the gum, a looseness of its tissue, may be called idiopathic, and frequently gives rise to other more severe diseases. Such a gum is either very pale and anæmic or redder than normal, relaxed, loose, and sponge-like, here and there puffy, and bleeding on the slightest provocation. The treatment of this condition will be spoken of later, since it can scarcely be separated from the cosmetic treatment of the teeth.

The teeth are the most worthy object of cosmetic treatment. Fine teeth and fine feet are the chief attributes of human beauty, and although a beautiful female mouth is the essence of all that is charming, even an ugly mouth may be beautified by a smile which discloses a pearly row of teeth. Perfect teeth are unfortunately as rare as perfect diamonds. No department of cosmetics is in such good hands

as that department which concerns the teeth. Medical science and technical skill have united to correct their frequent faults. This is not done altogether for æsthetic reasons, since the teeth have a very important function to perform in the process of digestion. The diseases of the teeth are many; the greater part, and caries in particular, demand the special assistance of the dentist, who stops cavities in their substance, removes those which are altogether bad, and replaces them by artificial ones. Even this important department of cosmetics has rapidly improved in late years, although it was known even to the ancient Egyptians. Apart from the diseases and the substitution of the teeth, the incrustations on the teeth and their bad color remain for us to consider.

By incrustations we understand deposits on the teeth of different varieties and colors, which have a varying consistence and require, therefore, different methods for removal. The chief ingredient is calcii phosphas, with which are mixed calcii carbonas, magnesii phosphas, and organic substances. The material is often hard and is only found in mouths having alkaline saliva; if the calcium salts be wanting entirely or in great part, it is soft and pasty, as in children. The soft form is found only where the saliva is acid. The hard, mostly brown or black deposits are found in men and especially in smokers; the soft, yellow or white colored deposits are found mostly in young women. Besides these, deposits of green, brown, and other colors have been described which depend in part on the presence of a microbe, the leptothrix buccalis. The deposits appear first on concealed portions of the inner surface of the front teeth and on the outer surface of the molars. Later the extent may become greater, and under some circumstances a whole row of teeth may be covered by it, so that they have the appearance of a single giant tooth (m. cur. dentatus). Only the soft deposits may be removed by the proper care of the mouth; the hard forms and the green incrustations require the instrumental interference of the dentist, and so shall not be treated of here.

In regard to the color of the teeth, it must be remembered that not only the yellow, but also the yellowish-white, the bluish-white, and the mottled teeth may be normal, and that the norm does not always correspond to what we consider the beautiful. The bluish-white teeth are by far the most beautiful, but in quality they occupy the third place.

Besides this principal color, a number of tints may be found. These latter may often be altered by proper chemical agents. This is not to be practised as a rule, since the teeth are injured by it. Other colors appear on single teeth or groups in consequence of diseases. These are called discolorations. The diseases which cause them are chiefly those of the pulp; temporary discolorations may also be caused by caries and some filling materials. Discoloration may also be found in general diseases. When the color is not due to the shining through of the filling, it depends on the coloring matter of the blood, or rather on bodies which owe their tint to the pure or altered coloring matter of the blood. Just as these under the skin give rise to all the tones from light red through yellow to blue or brown, they may produce the same effect in the teeth; there are a whole series of discolorations, of which the most frequent are light and dark red, blue, and dark gray. To cause these discolorations to disappear is a difficult task for the dentist. This is usually secured by filling the cavity with proper chemical agents and then stopping it with gutta-percha. All bleaching matters, such as chlorine and acidum sulphuricum, may be used; unfortunately, however, the effect is rarely all that could be desired.

Caries of the teeth, which will not be spoken of further here, is usually considered the cause of fœtor ex ore. The breath should have normally no odor, or when such is present it should only be that of the individual, and not the odor of carrion or of spoiled eggs. When a number of the teeth are extensively carious, the collections of necrotic tissue in the cavities may give the breath a foul odor. This is more often the case with particles of food which remain in the mouth. It should not be forgotten that there are also a number of other processes which may give rise to the fœtor. Dyspepsia and various other diseases of the stomach, especially carcinoma, as well as diseases of the mouth, nose, and pharynx, have the same effect. Many forms of ozæna which are localized in a small portion of the nasal mucous membrane are not recognized, and the fœtor is referred to another cause. Hypertrophy of the tonsils when the surface contains lacunæ which may give lodgment to particles of food may produce a very repulsive odor. Not less disagreeable is that caused by the plugs in the glands in follicular tonsillitis. Various diseases

of the gums and anomalous secretion and anomalous composition of the saliva may cause a fœtid breath. Simple toxic salivation is not so instrumental in causing this as the accompanying stomatitis and hypersecretion of saliva where it remains in the mouth, and the peculiarly viscid, tenacious saliva which shows itself in mucous bands stretching from lip to lip when the mouth is opened. This latter, as well as the diseases of the tonsils, pharynx, nose, and mouth, and more rarely the teeth, are proper objects for therapeutic treatment and especially for cosmetic. The fœtor caused by other diseases can only be removed by treating the disease, and then not in every case. Often the odor is but temporary; many women have during the menses a bad breath, which disappears in a few days. At any rate the cause of the fœtor must be searched for, and in many cases something may be accomplished in the matter of improving it.

The beginning of the cosmetic treatment is the exact carrying out of the hygienic treatment, and this reduces itself in healthy individuals with normal mouths to the simple care of the mouth.

First of all the mouth and the pharynx are to be washed out before the cleaning of the teeth takes place. This washing out is in most cases improperly done. To wash out the mouth thoroughly, it must be done in three steps. First, the pharynx and the tonsils are to be washed. To accomplish this the head should be thrown back, and while the mouth is kept open the first act of swallowing is performed and the water then ejected. Gargling is of no service. After the posterior cavity of the mouth has been freed from mucus by the procedure described, the middle cavity, limited behind by the soft palate, before by the teeth, is to be washed by bending the head to one side after the other. Lastly, the anterior cavity between the teeth and the lips is washed out. Here, in order to cleanse well the interstices between the single teeth, it should be recommended to force the water back and forth through the closed teeth by alternately contracting and relaxing the muscles of the cheeks and lips. The composition of the water used is of little importance when the mouth is healthy, providing only that directly injurious agents be not used. As a rule, simple water is sufficient, which to suit the taste of the individual may be flavored with any ethereal oil, or better with an alco-

holic solution of an ethereal oil. The temperature of the mouth water is of much greater importance. The laity believe in the virtue of very cold water, but it is better to use a temperature which is pleasant to the mouth.

In the simple washing of the mouth only the loose particles of food and mucus are removed; those between or on the teeth remain. In order to remove these latter the finger alone or enveloped in a bit of linen may be used. This procedure is worse than the simple washing, since soft deposits on the teeth and mucus are rubbed over the surface of the teeth and even pressed into the interspaces. The teeth, as a rule, are thoroughly cleaned by means of a tooth-brush. Many individuals do not require this. Those are such as have teeth very close together and such as only take hard articles of food, which act as a cleansing agent for the teeth. Apart from laborers and peasants, brandy-drinkers have, as a rule, fine teeth; in these persons the alcohol acts as a cleansing and disinfecting agent. Persons in better circumstances and the inhabitants of cities in general require the tooth-brush more, since they eat softer food. The form of the brush is of no importance, but the breadth and the hardness is. The laity believe that hard brushes are injurious, since the gum is often torn by them. In general hard brushes should be used where the gums are normal; for milk teeth, or those with white enamel, softer brushes may be used. One may become accustomed to hard brushes, and gradually go over to such. If the gum bleed when the teeth are brushed, this indicates disease of the gum, hyperæmia, loosening, or inflammation. The energetic brushing of the gum is the best therapy for it, since under this treatment it becomes harder and more solid. For this reason narrow brushes should not be used, since they do not touch the gums. Besides this, they have the disadvantage that they wound the gums easily, since they do not completely fill out the canal and may readily be misdirected. The hardest brushes are made of pig bristles, medium hard of the bristles of young pigs, and soft of horse or badger hair. Four rows of bristles should be used by adults and two or three by children. Tooth-brushes are also generally improperly used. The brush is rubbed horizontally back and forth, and the individual believes that this is all that is necessary. In this way the deposits between the teeth are left. The teeth should be

[illegible] in a vertical direction, those of the upper jaw [illegible] downward, those of the lower jaw from below upward and then brushed horizontally. The grinding surface should next be brushed and finally the posterior surface.

The mouth should be cleaned at least twice a day, morning and evening; more frequent washing, however, after the meals and after smoking is advantageous. After the cleaning of the mouth and teeth comes the use of the tooth-pick. This procedure although disagreeable to the beholder, is certainly good and even necessary for most persons. The laity err for the most part in believing the use of the tooth-pick to be unhealthy; while for removing particles of food it serves not only a cosmetic purpose, but a hygienic one as well. The tooth-pick should be made of elastic wood, or tortoise-shell which is not too hard, or ivory; a pointed quill answers the same purpose. If the picking the teeth with steel instruments or with a fork or needle be condemned, it is chiefly because wounds may easily be produced in this way.

The number of cosmetics used in the mouth is very great. Many of these act excellently, many indifferently, and many in a harmful manner. The indications for and the manner of employment of various drugs will be given here, although it should be said that the cosmetic care of the mouth, since mostly mechanical, must consist principally in the use of great quantities of fluid, mostly pure water, and the brush. When other medicinal agents are used this should be but rarely, as at intervals of from one to two weeks, or only when absolutely required, as in the case of most deodorizing agents.

Neutralizing Agents.

Acids and Alkalies.

The acids act as moderate astringents on the mucous membrane, and as neutralizers of the alkaline saliva. If concentrated acids be long used they may attack the enamel and so give rise to caries. The acids have also some disinfecting property, although they would hardly be employed for this purpose. And for neutralization even they need be but rarely and temporarily employed. Of these should be mentioned acidum hydrochloricum, phosphoricum, oxalicum, and lacti-

cum. Acidum oxalicum would hardly be used on account of its acid properties, but rather on account of its bleaching properties, if it were not to be avoided altogether on account of its poisonousness. The acids are usually prescribed in from two to four per cent. solution and their injurious nature called attention to.

The use of alkalies is more often indicated than the use of acids, and the former are given in solution or in the form of tooth powders. In the first case they have only the purpose of neutralizing the acid saliva; in the second they act as a mechanical cleansing agent. In powder or in concentrated solution they may finally extract the fat present in the teeth, as is shown by the fact that teeth naturally yellow become as white when alkaline tooth powder is used as if they had been soaked in ether. Caustic and carbonate alkalies can do harm by loosening the epidermis.

℞ Acid. phosphor., ... gr. xvi.
Aq. destil., ... ℥ iiiss.

For removing the black edges of the teeth after the water of iron springs has been used. Acidum oxalicum may also be used for this purpose.

℞ Acid. hydrochlor. dil., ... gr. v.
Aq. destil., ... ℥ iiiss.

M. S. Mouth water when the saliva is alkaline and stringy.

℞ Sodii bicarb., ... ʒij.–ʒ iss.
Aq. destil., ... ℥ iiiss.

M. S. To be used when the saliva is acid, or after the use of strongly acid foods.

℞ Cretæ alb., ... ℥ i.
Magnes. carb.,
Sodii bicarb., ... ää gr. xvi.

M. S. Tooth powder; to be used every two weeks when the saliva is acid.

Astringent Agents.

Acidum tannicum and the allied acidum gallicum are the most important of these. They both raise the tone of the tissues, harden softened gums, and decrease the secretion of saliva. The alcohols are also astringent agents, which in the

beginning increase the secretion of saliva by their local irritation and then decrease it. Since these latter possess antiseptic properties, the tannin containing agents are given in alcoholic solution as mouth water or as tooth tinctures. The astringent agents commonly used are cortex cinchonæ, cortex salicis, rad. ratanhæ, catechu, liq. campechianum, fol. salviæ, fol. cochleariæ, and vinum rubrum. These drugs are given in decoction, in infusion, in tincture, and also in the form of tooth powder and pastilles. Alumen is a very important astringent which is employed in hypersecretion of mucus or saliva, and in inflammations and swellings of the mucous membrane of the mouth and the gums. It is used in solution or more rarely in powder.

℞ Acid. tannici, ... ʒi.
Tinct. pyrethri, ... ʒ iij.
Aq. rosæ, ... ℥ vi.
M. S. Gargling water (Stocken [84]).

℞ Tinct. cinchonæ,
Tinct. ratanh., ... āā ℥ ss.
Ol. caryophyll., ... gtt. v.
M. S. Tooth tincture (Scheff [85]).

℞ Tinct. gallar.,
Tinct. ratanh.,
Tinct. spilanth. oleac., . . . āā ʒ iij.
Ol. menth. pip., ... gtt. v.
M. S. To be pencilled on the loosened gums.

℞ Tinct. ratanh.,
Tinct. myrrhæ, ... āā ʒ iij.
Aq. colon., ... ℥ ij.
M. S. A teaspoonful in a glass of water for rinsing out the mouth. It has a red color and by dilution with water becomes milky and foamy.

℞ Aluminis, ... ʒij.
Decoct. fol. salviæ, ... ℥ x.
M. S. To be used lukewarm for sensitive gums.

℞ Extr. rad. liquir.,
Aq. calid., ... āā ℥ iiiss.
Catechu pulv., ... ℥ i.
Gum. acaciæ, ... ℥ ss.
Evapora in balneo Mar. ad consistent. extracti, dein adde
Cort. cascarill. pulv.,
Mastiches pulv.,
Carbon. veget. pulv.,
Rad. irid. flor. pulv., ... āā 3 ss.
Semirefriger. adde
Ess. (ol.) menth. pip., ... 3 ss.
Tinct. moschi,
Tinct. ambr., ... āā gtt. v.
M. f. pastill. Obduce fol. argent. S. Cachou de Boulogne (Dorvault).

℞ Extr. ratanh., ... 3 i.
Roob. ribium, ... 3 ij.
Sacch. alb., ... q. s.
ut f. pastill. No. 35.
S. Pastilles.[36]

℞ Vini rubri, ... ℥ vi.
Succi citri,
Sacch. alb., ... āā ℥ ss.
M. S. Mouth water (Kleinmann).

Antiseptic Agents.

The agents of this group prevent in most cases the decomposition of the bits of food remaining in the mouth, the mucus, and the bits of tissue thrown off in caries of the teeth and other diseases. In consequence of this action they are capable of removing the bad odors arising in such cases and may, therefore, be used as deodorantia.

All these deodorizing agents conceal the odors from other diseased organs only by their more powerful smell, and this holds also in the cavity of the mouth.

Among these antiseptic agents are most of the ethereal oils and the drugs containing them. The amount introduced at one time into the mouth is too small to be really disinfecting, but the odor is so strong that it often conceals the fœtor

completely; in many cases, however, only a mixed odor is produced, which is unpleasant. Ethereal oils introduced into the mouth have an astringent action and also increase the flow of saliva, and on account of this latter action are very popular. Apart from these effects produced, it can hardly be supposed that they have a special action on the mucous membrane of the mouth. They have been used for the mouth and teeth for many centuries (myrrha, mastix, mentha). Such agents are rad. pyrethri, fructus capsici, hba. spidanthis, caryophylli, hba. menthæ, rhiz. iridis, calamus, zingiberis, cinnamomum, camphor, benzoin, mastix, musk, and myrrh. The astringent fol. salviæ and cochleariæ also contain ethereal oils.

℞ Tinct. myrrhæ,
Tinct. benzoini, ... āā ʒ i.
Spir. cochlear., ... ℥ iss.
M. S. Tooth tincture.

℞ Rad. irid. flor., ... ʒ iss.
Myrrhæ,
Coccionell., ... āā ʒ ss.
Ol. caryoph., ... ♏ viij.
Ol. cinnamom., ... ♏ v.
Mell. rosati, ... ℥ ss.
M. S. Dentifrice.

℞ Tinct. pyrethri,
Tinct. calami, ... āā ʒ i.
Tinct. mastiches, ... ʒ ss.
Spir. frumenti, ... ℥ ij.
Ol. caryophyll., ... gtt. iij.
M. S. Ten to twenty drops in a glass of water for washing out the mouth.

℞ Rad. calami,
Cort. salicis, ... āā ʒ ij.
Tartar. depur., ... ʒ ss.
Ol. caryoph., ... ♏ viij.
M. f. pulv. subtilis. S. Tooth powder (Kleinmann).

Directly antiseptic in their action are phenol, creosote, pyroligneous acid, and salicylic acid. The first three, in the concentration in which they are generally employed, overcome

the fœtor by their specific odor. Agents which would be really antiseptic cause unpleasant symptoms of irritation, may cauterize, and can even produce intoxication. Acidum salicylicum is not to be used, although at the time of its introduction it was regarded as a specific for fœtor in the mouth, caries of the teeth, and affections of the gums. It not only produces inflammation of the mouth and gums, but when used as tooth powder attacks the enamel of the teeth.

℞ Creosoti, ... ♏ xvi.
Aq. destil., ... ℥ vij.
M. S. Mouth water.

℞ Acidi carbol. cryst., ... gr. xvi.
Aq. destil., ... ℥ vij.
M. S. Mouth water.

The chemically-acting agents are the most powerful disinfectants. Such are chlorine in the form of chlorine water and calcii chloridum. These are very energetic in their action and are the surest deodorantia. They cannot often be used, however, since the chlorine and acidum hydrochloricum which it forms act on the enamel of the teeth, and besides this, the odor and the taste of the two agents are very unpleasant and difficult to correct. Potassii permanganas is more often used. Its deodorizing action in the mouth is excellent and surpasses its antiseptic action, which, since the agent is so soon reduced, does not accomplish much. The unpleasant feature of its use is the brown discoloration of the teeth and tongue which it produces. Its metallic astringent taste also prevents its use somewhat.

℞ Calc. chlor., ... ʒ i.
Aq. destil., ... ℥ vij.
Post hor. 12 filtra, adde,
Ol. menth., ... ʒ ss.
M. S. Mouth water.

℞ Potassii permangan., ... gr. xvi.
Aq. destil., ... ℥ ij.
M. S. Two to three teaspoonfuls in a glass of water as a deodorizing agent.

℞ [illegible]
[illegible] . . . . . ℥ ss
M. ft. [illegible]

℞ [illegible] . . . . . ℥ vij
[illegible] . . . . . ℥ v
M. ft. [illegible] for removing the stains of [illegible] permanganate [illegible] may also be used for this purpose.

The simplest and most convenient and most innocuous antiseptics are potassii chloras and acidi boric. Both prevent decomposition, disinfect the mouth and remove the fetor. The latter action is slow but is only noticed after continued use. They may, however, be used for a long time and in concentrated form. The taste of both is not specially agreeable and may be corrected by an addition of Oil. Both have a marked effect in arresting the secretion of saliva, especially in cases of salivation. The more energetically acting of the two, the potassii chloras being an oxidizing agent, has the property of increasing the acidity of saliva and of making it more corrosive.

℞ Potassii chloras . . . . . ℥ ij
Aq. destil. . . . . ℥ viij
Aq. menth. pip. . . . . ℥ ss
M. S. Mouth wash.

℞ Acidi borici . . . . . ℥ ss
Aq. destil.
Aq. salviæ . . . . . aa ℥ iiss
M. S. Mouth wash. Shake.

Carbon belongs to the disinfecting agents and may also be considered a mechanical cleansing agent. It deodorizes promptly and might be used for tooth powder very widely. Although one of the oldest and most used tooth powders, its use is in some degree harmful since besides marked cosmetic faults, like most of these agents it attacks the enamel and even the dentine when long used. The brushing with powdered carbon, especially in the horizontal direction, produces a defect in the neck of the tooth and the gum is tattooed dark blue from the particles of carbon being rubbed in and healing in the gum. This color is permanent. It is quite indifferent

what sort of carbon is used, whether it be wood charcoal, or animal carbon, or bread carbon from burnt bread-crusts. It should be remarked that the beneficial effects appear soon after its use is commenced, and that the injurious effects only come on after its continued use.

℞ Cinchonæ,
Fol. salviæ,
Carb. ligni dep., ... āā ʒ i.
M. ft. pulv. subtil. S. Pulv. dentifricius niger (Austrian Pharm.).

℞ Sacch. alb. pulv., ... ʒ iiiss.
Carb. veget. (aut panis) loti et porphyris., ʒ i.
Vanillæ, ... ʒ i.
Mucil. gum. traganth., ... q. s.
ut f. pastill. pond. gr. xiv.
M. S. Pastilles de charbon (Dorvault, after Chevallier) for fœtor of the breath.

Polishing Agents.

These act mechanically. The coarser the grain of the powder used, the more easily is the enamel scratched, and under its continued use this may even be destroyed. Even when fine powders are used the enamel becomes thinner, and cracks in consequence of its lessened resistance. Many of these agents have also a chemical action like the alkalies and alkaline earths. To this group belong sodii carbonas, magnesii carbonas, and calcii carbonas, which latter is used in the various forms which are found in nature. It is indifferent whether burnt marble, chalk, os sepiæ, oyster shells, or red coral, be used as tooth powder; the cost is all that determines the choice. On account of their chemical action these agents cannot be used continuously, but only from time to time, and on account of their mechanical action they should only be used as the finest sifted powders. This latter is particularly the case with pumice-stone, which whitens the teeth, but injures the enamel if long employed. The soaps should also be considered as belonging to these agents, since, as on the skin, the suds suspend the dirt and deposits which occur on the teeth and so render the removal of these easy. It goes without

saying that only neutral and hard soaps, such as soda soap, should be used.

℞ Pulv. oss. sepiæ, ... ʒ iss.
Pulv. irid. flor.,
Pulv. magnes. carb., ... ää ʒ i.
Ol. menth. pip., ... gtt. v.
M. S. Heider's tooth powder.

℞ Oss. sepiæ,
Lap. cancror., ... ää ʒ vi.
Cort. cinnam.,
Rad. irid. flor., ... ää ʒ ss.
Carb. tiliæ, ... gr. xvi.
M. exactis. S. Gray tooth powder (Carabelli).

℞ Sapon. amygd.,
Magnes. carb., ... ää ʒ ss.
Pulv. rad. ir. flor., ... ʒ i.
Carmini p., ... gr. iij.
M. exactis. S. Tooth powder.

℞ Sapon. medic., ... ʒ vi.
Carmini, ... gr. iss.
Sol. in Spir. vini, ... ʒ ss.
Myrrh. pulv., ... gr. xvi.
Ol. menth. pip., ... ʒ ss.
Calc. carb. præc., ... ʒ iss.
M. c. Glycerini, ... ʒ i.
S. Tooth soap.

The form in which these agents are used, as well as the manner of their application, is seen from these examples. Mouth waters are perfumed or sweetened solutions or mixtures; undiluted or diluted with water, they are used for washing out the mouth. The tooth tinctures are alcoholic solutions of ethereal oils or extracts from drugs containing such. They are either pencilled on the gums or added in small quantities to ordinary water, whereby as a rule a cloudy emulsion-like fluid is obtained which foams when washed about or brushed in the mouth. Tooth powders are in solid or semi-solid form, mixtures of one or several fine powders, to which is added a perfume in the shape of an ethereal oil or a fragrant vegetable

powder, and a coloring matter such as carmine, cochineal, extr. campech., extr. santali rubri, or sanguis draconis. They are applied, as a rule, by means of a brush moistened in water, and rubbed unfortunately in a horizontal direction for the most part. In this way they injure the enamel much more than when brushed vertically. What was said of the others will serve also for the tooth powders and pastes. They should not be used oftener than once in two weeks. The tooth pastes are tooth powders which are made into soft pastes with glycerin, syrup, or honey, and into hard with alcohol. Soap is often added to these pastes; if this be the chief constituent the paste is called tooth soap, by which is also understood ordinary strongly perfumed soaps or solutions of such in alcohol. Pastilles should also be spoken of. These are either used as simple astringent agents in place of mouth water or to remove or conceal a fœtor of the breath. The latter go under the general name cachou, since their chief constituent is often catechu, but even those are called by this name which contain no trace of terra japonica. Pastilles are dissolved in the mouth; cachoux are chewed up but not swallowed.

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ON

AFFECTIONS OF THE STOMACH

IN

DISEASES OF THE MALE GENITAL ORGANS.

BY

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ON

AFFECTIONS OF THE STOMACH.

"It was indeed a progressive step," says Richard Ewald in C. A. Ewald's clinic of diseases of digestion, "when the old idea of vital force was discarded and men would admit only physical explanations for the processes occurring in the organism." Physical aids were brought to the investigation, and the vital processes were referred to physical laws.

But the results of the purely physical explanations have been in a measure disappointing, and especially so in diseases of the stomach, since clinical experience shows that a great number of morbid symptoms are not explained by the pathological processes found.

Physicians began then to direct their attention to the nervous or reflex anomalies of this organ, by which we now understand those affections which result from the disturbed function of its nerves.

The results of this study make up our present knowledge of the neuroses of the stomach.

A superficial knowledge of the subject is not new, since it was formerly treated especially by French and English authors; but in late years we have advanced very much in the understanding of these diseases, principally through the writings of Leube, Stiller, Oser, Rosenthal, and Ewald.

Our knowledge, however, is not so complete but that new contributions to it may be welcome.

It has long been recognized that the diseases of the female genital apparatus play an important rôle in the production of neuroses of the stomach.

"Next to the brain," says Stiller ("The Nervous Diseases of the Stomach"), "the uterus with its adnexa is the organ whose diseases most frequently cause reflex troubles of the stomach.

The female genitalia surpass the brain in fact, not only in their more frequent irritation of the stomach, but also in producing a more complex form of gastric trouble, since they produce not only vomiting, but also cardialgia and all the symptoms of dyspepsia. It is more especially retroflexion which causes a whole series of reflex symptoms, so that besides the menorrhagia, the sudden discharge of secretion from the dilated uterus, the pain in the back, the disturbed and painful defecation—*i.e.*, besides the mechanical effects of this form of disease—the headache, the nausea, the disturbed appetite, the dyspeptic symptoms with severe gastralgia, form a combination of symptoms, which, as Hildebrandt says, make it possible for the skilled practitioner to diagnose retroflexion with certainty in the majority of cases before the physical examination. The literature gives many cases and practice still more in which continued vomiting, obstinate cardialgia, and dyspepsia were cured by the cauterization of vaginal erosions, by the removal of small polypi, by the dilatation of the neck of the uterus, by replacing the uterus; in short, by the removal of uterine disturbances.

The connection between neuroses of the stomach and chronic diseases of the male genital organs has been scarcely noticed.

It is now my intention, referring to histories of about 300 cases, to speak of the nervous affections of the stomach which appear in causative connection with the chronic diseases of the male genital organs—*i.e.*, which represent reflex neuroses.

The histories, collected in the course of fifteen years' practice, are mostly of cases which have arisen from abusus sexualis, masturbation, and frequent coitus reservatus. The underlying pathological condition is for the most part a chronic inflammatory affection of the mucous membrane of the pars prostatica urethræ. In some cases there was a chronic urethritis of an infectious nature. The manner of the development presupposes in most of the cases a decrease in nerve strength and an impoverishment of the blood from the considerable loss of semen. These two factors lead in the end to that condition of the nervous system which we call neurasthenia sexualis. Among the most frequent symptoms of this disease are the nervous or reflex affections of the digestive organs.

The diagnosis of nervous and especially of sexual neurasthenic affections, or rather the differential diagnosis between them and organic diseases, may often be difficult. The chief diagnostic point is furnished by the products of the chronic urethritis which are carried off in the urine. These products are often pathognomonic. The presence of the secretion of the accessory genital glands in the urine is rare. The passage of this secretion, if it is noticed, is often mistaken by both patient and physician for another disease of the genital system, which also can be diagnosed, as a rule, only by the accurate microscopic examination of the urine—that is, spermatorrhœa.

In urine containing semen we find occasionally another element, the so-called testicle casts. The foreign elements most frequently found in the urine of patients with sexual neurasthenia are the urethral threads, the product of a chronic inflammation of the urethral mucous membrane, whether this be produced by infection, masturbation, or by other means. I would refer for information on this subject to my paper, "The Urine in Neurotic Diseases" ("Wood's Medical and Surgical Monographs," Vol. VIII., No. 1).

If we have before us a case of chronic disease of the stomach, let us say "cramps," which come on mostly when the stomach is empty and disappear after food is taken, if the appetite is good, perhaps excessive, the tongue not coated and the digestion normal, if the physical examination gives negative results, and if other nervous symptoms are present, as *e.g.*, spinal irritation, mental exaltation or depression, constipation and irritable bladder, we should suspect a nervous affection of the stomach. If the history informs us of preceding long-continued abusus sexualis, if we find in the urine one or more of the foreign elements mentioned above—*e.g.*, semen—our probable diagnosis becomes more certain, and we begin a local treatment of the sexual disease, the results of which treatment finally verify the diagnosis.

It is not my intention to write an exhaustive treatise on this subject, but to offer a contribution especially as to its etiology; for no one who has interested himself in the matter, will deny that in practice the necessary attention has not been given it.

Among the old authors who spoke of the connection be-

tween stomach affections and diseases of the male genital organs, Lallemand takes the highest position. The section which treats of this subject is one of the best and truest in his famous book, "Des pertes séminales involuntaires," to which I shall make frequent reference.

Tissot says that the troubles which most frequently follow onanism are a complete derangement of the stomach, shown in some patients by the loss of appetite or irregularity of the appetite; in others by acute pains, especially during the period of digestion, and by continuous vomiting which resists all forms of treatment as long as the patient continues in his bad habits.

Curschmann, in his excellent work on the functional disturbances of the male genital organs, calls disturbances of digestion the most frequent symptoms in persons who suffer from functional diseases of the genitalia. The nervous nature of these symptoms is indicated by the fact that they appear in the same individual without preceding errors of diet, at different times and in different manners; that they come on brusquely and vanish again without treatment.

The stomach lies in the middle point of a complicated nerve network, which brings many organs into direct or indirect relation with it. In consequence of this, an irritation of any portion of this network may express itself on the stomach as on a peripheral end organ (Ewald).

Chief among these irritations are those which are due to chronic affections of the genital organs.

The stomach, as is well known, is innervated by the vagus and the sympathetic. It is generally accepted that the vagus provides the stomach with sensitive fibres; opinions are divided as to whether the vagus causes the specific general feeling of the stomach, the sensation of hunger; and it is also doubtful whether the vagus influences the secretion of the juices of the stomach.

Less contradictory are the views in regard to the influence of the cœliac, or solar plexus, according to Hyrtl the largest and richest network of the sympathetic. A number of eminent investigators like Budge, Donders, and Brinton saw movements of the stomach after irritation of the cœliac plexus, the first thoracic ganglion, or the two sympathetic nerves.

It is generally accepted that the cœliac plexus supplies the

stomach with sensitive fibres; this view is supported also by the fact that operations on this network are very painful.

Many experiments have been made for the purpose of determining the influence of the sympathetic on secretion. While some claim to have seen disturbances of secretion and nutrition after extirpation of the cœliac plexus, others deny it. The only indisputable fact is that hyperæmia of the stomach follows destruction or section of the vagus and splanchnic nerve (Schiff). Experimental physiology gives us very little clue as to the influence of the nervous system on the motility and secretion of the stomach, while experience teaches us that all the functions of this organ depend in fact on nerve influence.

Hegar called the numerous nervous affections found with uterine disease (nervous vomiting, cardialgia, etc.) symptoms on the part of the lumbar portion of the cord. Rosenthal (on "Affections of the Stomach in Diseases of the Female Genital Organs") did not consider this classification correct, since the affection of the lumbar cord is contra-indicated by the favorable course of the symptoms even after many years' standing, by the persistence of the patellar tendon reflex, and by the absence of disturbance in spinal conduction.

We shall divide the subject of the neuroses of the stomach into motor, sensory, and secretory neuroses.

A. Motor Neuroses.

Among the different forms we find most frequently

Atony of the Stomach, or Gastroplegia.

By this term (synoyms, paresis or insufficiency of the stomach), we understand a condition in which the stomach walls, in consequence of deficient innervation, perform their movements with a lessened force and energy. This affection occurs at times together with dilatation of the stomach; it is not, however, identical with this. "After a longer or shorter period," says Lallemand, "according to the strength of the stomach, digestion becomes less easy, less satisfactory, more laborious, etc. In this state of affairs, if the excess or abuse stop, the fatigue of the digestive organs is soon recovered from."

Curschmann remarks that in the beginning in many cases

there is not a loss of appetite, but an excessive appetite, and for a time the patient bears the increased amount of food well. But gradually eructations, nausea, and a feeling of tension, etc., come on after eating. This paresis is also found as a result of the most varied mechanical and chemical influences, and the differential diagnosis of the nervous form can often not be made in the beginning. The clinical symptoms of the affection vary with the different grades of intensity and with the different forms, acute, subacute, and chronic.

In the beginning the atony is often only an acute one, lasting half a day or perhaps several days. A patient with ordinarily good appetite and normal digestion, after a pollution without erection, for example, notices a complete want of appetite in the morning, which may pass away by noon or evening or may continue two or three days. If the patient eats, he has often a feeling of heaviness and tension in the gastric region; yet the affection passes off, the patient not paying much attention to it, and it recurs after the next pollution. At other times the patients have a normal appetite, but are troubled after eating by tension in the pit of the stomach, which lasts until the stomach is again empty.

I have seen very striking cases of this sort. A young scholar suffered from frequent pollutions, but had a tolerably good digestion. If he fell asleep after dinner and had then a seminal emission, the digestion of the meal was tedious and painful; he had a feeling of great heaviness in the region of the stomach, and when he moved, heard a perceptible splashing. By the following day the affection would entirely disappear.

In other cases there was found the peculiarity that the innervation of the stomach kept pace with the appearance of the general neurasthenia—*i.e.*, was dependent on the time of day.

With a young chemist who suffered from a severe sexual neurasthenia with nervous diarrhœa, the neurasthenic symptoms were more marked in the morning. At this time he had numerous diarrhœic passages and the appetite was negative—*i.e.*, the sight of food and even the thought of it caused nausea. In the evening, when the whole nervous system of the patient was in better condition and he felt well disposed, a natural feeling of hunger and normal digestion returned. In this form

of stomach neurosis, as a rule, the tongue is not coated, and when there are eructations these are not accompanied by disagreeable and acid odors.

The cases of chronic atony of the stomach are most frequently the results of sexual anomalies. The clinical symptoms may consist simply of loss of appetite; the patient feels no special pain after eating, but does not have that comfortable feeling of well-being which a good table and a natural digestion should produce. At other times there may be a fairly good appetite, but after eating, the patient experiences a tension in the epigastrium, which is unpleasant chiefly on account of its long duration. If the patient drinks moderately at table, a splashing is experienced with every movement. On washing out the stomach we find that it is not yet emptied of its contents, although the process of digestion is not abnormal.

The chronic atony of the stomach is, as a rule, connected with a more or less severe spinal irritation.

This condition is frequently confused with another neurosis of the stomach, the so-called anorexia (ἡ ὄρεξις, a craving), a want of appetite. The latter depends on a sensory neurosis of the nerves of the stomach, an anæsthesia of these, and reveals itself by the fact that there is also a want of the feeling of satiety. The patients have indeed no feeling of hunger, but when they begin to eat they have no feeling of satiety, but may continue to eat without knowing when they have eaten enough. Very interesting are the experiments which Fleischer made as to the duration of digestion in women at the menstrual period. By washing out the stomach, he found a constant retardation of digestion during menstruation. It was especially slow when the loss of blood was great. Abnormal conditions of the sexual organs in the male may also exert an influence on the organs of digestion.

Nervous Belching—Eructation.

The belching of air, which is swallowed for the most part with the nutriment and is found more or less in every stomach, is perfectly physiological; it is pathological only when the air is thrown off in enormous quantities and often with a loud noise. That this is merely atmospheric air is generally believed, but opinions vary as to how it gets into the stomach.

The common view is that the air is swallowed; Oser remarks, however, that in this case one should notice something of the process. According to him, the air gets into the stomach by asipration, without the motion of swallowing. "If we assume," says he, "that the stomach is emptied by the contraction of its circular fibres, and that a lumen is again produced by the contraction of its longitudinal fibres, providing that the cardiac orifice is open, air must rush from the œsophagus into the stomach without the act of swallowing. The next contraction of the stomach forces the air out again." Oser says: "For example, let one suppose, in place of the stomach, a balloon in connection with the œsophagus. Every time that the balloon is compressed the air is driven into the œsophagus, and every time that it expands the same quantity of air must be sucked back into the balloon."

Oser classes this neurosis with the motor neuroses, since the air can be thrown off only by a more or less intense contraction of the stomach, and since also in many cases an increased peristalsis lies at the bottom of it.

According to Ewald, there is another variety of eructation in which the stomach has no part, but air is forced out of the œsophagus by contraction of the muscles in the neck. Ewald says that he can cause eructation at will, and that he has convinced himself by means of the noise made in swallowing that air pressed into the œsophagus does not reach the stomach at all, or only passes the cardiac orifice when a second swallowing movement is made. Eructations may come then from the œsophagus alone, and this is probably for the most part the case, when the stomach is not dilated.

I have seen this nervous eructation but seldom with sexual anomalies in the male, and its frequency cannot be compared with that of the hysterical eructation in the female.

As an example I give the history of a neurasthenic Catholic priest, æt. 35, who suffered from spermatorrhœa. In the afternoon and at night he suffered from violent eructations which, lasting for hours, rendered respiration difficult. At the same time the belly is puffed up like a drum.

The eructations cannot be supposed to have come from the œsophagus in this and in the following case. Sch., æt. 26, surveyor, a strong man, enjoyed good health up to his twenty-first year, in spite of frequent masturbation. Then came on

by degrees a feeling of fulness, the stomach puffs up, and after eating he has eructations often accompanied by vomiting. After this there is a feeling of burning in the epigastrium and the throwing off of a very acid stomach secretion. Finally the eructation of great quantities of wind occurs. If this does not come on, there is a feeling of fulness and oppression in the chest. The patient cannot produce the eructations at will. The local disease of the genital system is a spermatorrhœa. The eructations are sometimes accompanied by the passage of large quantities of odorless wind per rectum. I have found but one such case among all my cases of neurasthenia.

It should be remarked that the eructations often appear in conjunction with regurgitation and rumination. More frequently than the eructation, is found

Flatus.

The stomach fills with air, dilates, and produces not only the feeling of unpleasant tension, but may also give rise to severe nervous symptoms (as in the Catholic priest mentioned) through pressure on the abdominal organs, and through pressure on the heart by forcing the diaphragm upward. Eructation alone brings relief. This condition may be explained by supposing first that atmospheric air gets into the stomach, and then that a spasm occurs of the openings, which prevents the release of the air. This flatus is often found with eructation, or the latter is caused by the former, as the history of the surveyor Sch. illustrated. In this case the flatus existed by itself for a year, and the eructation came on later.

A moderate degree of flatus is found very often with chronic diseases of the male sexual system. The patients complain that they feel full and puffed up continuously or at times independent of eating. On the contrary, they feel this fulness often more when the stomach is empty.

We have illustrated by the history of surveyor Sch. how the flatus may be chronic and continuous. It may afflict the patient constantly for years, it may also appear chronically at irregular intervals, so that it is present for days at a time and then disappears, or it may come on several times in the same day.

A typical case of this sort of affection was shown by St., merchant, æt. 45, strongly built and healthy appearing, who suffered from irritable bladder and defecation spermatorrhœa. Some days his stomach and intestines were so swollen that his wide waistcoat was quite filled out; other days the patient was slender and the same waistcoat hung in folds about him. This was quite independent of what he had eaten, and varied as he felt well or indisposed. Though these cases are frequent, I have seen but one case so severe that asthmatic attacks were caused by it (Henoch's asthma dyspepticum).

While flatus dependent probably on spasm of both orifices of the stomach is found very often with sexual anomalies, we seldom find only a

Spasm of the Cardiac Orifice and Œsophagus.

Lallemand called attention to this condition, which may be caused by the morbid loss of semen, in the following words: "Some patients feel at times spasmodic contractions of the œsophagus, which hinder deglutition, especially in the case of very hot or very cold fluids. These sudden, painful contractions, provoked by unaccustomed sensations, become for some instants an absolute obstacle to the passage of everything that presents itself, as if a knot were tied at some point in the œsophagus, most frequently its cardiac extremity. This explains perfectly the spasmodic contractions which mount from the intestines to the larynx like the globus hystericus. According to the investigations of Schiff, the cardia is not closed like other organs which have openings surrounded by a sphincter, by the tonic contraction of this sphincter, but by peculiar movements which take place in the lower part of the œsophagus.

There are alternate contractions and dilatations and the closure is not always at one and the same place, but varies continuously in the lower third of the œsophagus, so that even when the cardiac orifice is open, the œsophagus may be closed at some point above.

The fact, however, that a closure of the cardia takes place is indisputable, and is shown by observations of sound and diseased stomachs. The affection often offers clinically decided peculiarities. I have observed the two following cases.

Professor U., æt. 41, a strongly-built man, married, father of four children, complained five years ago of asthma and general nervousness. A vacation spent in the mountains restored his health. A year later, the nervousness came on a second time; patient is very irritable at his recitations; he complains of heaviness of the head, inability for work, and ascribes his condition to overwork. A long rest in the country brought temporary improvement. The former trouble, however, soon returned, and with it another affection which comes on in the following manner: the patient feels at times, often on successive days, a slowly developing feeling as of violent contraction in a small localized point in the cardiac region. This condition may continue for hours and become so severe that the patient sweats. The feeling at times passes upward in the œsophagus to the throat and strangles the patient. It may again pass slowly downward to the cardia. At times the patient feels it throughout the whole extent of the œsophagus, but severely only in one point. If during a spasm the patient attempts to drink, this causes no pain; the fluid passes downward, however, very slowly; the patient feels that it slowly overcomes difficulties in its passage, and he indicates with the finger the point at which it is at a given moment. If the spasm is at the cardiac orifice, the fluid passes this point with great difficulty and only after a considerable time.

A similar process occurs when the patient eats during the spasm. It often happens that solid mouthfuls remain some time before the cardiac orifice. After eating or drinking the patient cannot produce eructations when he has the spasm, as he does at other times.

After the condition described had existed a long time with varying severity, the patient consulted me on account of a new symptom. For some time he has been compelled to urinate frequently, which often causes a slight burning, and at the same time he has a sensation of tension in the region of the bladder—*i.e.*, "irritable bladder." The condition of the general nervous system is bad and the œsophageal cramps continue as before. The affection of the bladder induced me to make a careful examination of the urine. I found a chronic urethritis in consequence of a previous gonorrhœa, and excessive spermatorrhœa. The latter is to be ascribed in part to a frequent indulgence in coitus reservatus.

With the daily application of cold the irritability of the bladder soon passed off, and the spasms of the œsophagus as well.

One day, the patient having undergone a severe mental and physical strain, the spasms of the œsophagus returned. The patient came to me at once, I introduced the psychrophore, and in five minutes the spasm had ceased. Finally, complete recovery after treatment of the genital affection.

The second case was as follows: R., merchant, æt. 44, strongly built but anæmic appearing, intelligent and industrious, who does not smoke and uses liquor very rarely, has suffered for years from neurasthenia sexualis, manifesting itself by severe headache, sleeplessness, irregular action of the heart, etc., as a result of spermatorrhœa.

After unusual efforts one or the other of these symptoms appears, especially severe migraine. For some time the patient has noticed that often the migraine disappears, to be succeeded by another remarkable symptom. Exactly in the location of the cardiac orifice he experiences a severe cramp, which often is very painful and may last for hours.

When the patient eats, he feels that the painful point offers an obstruction to the passage of the food; it remains at this point and only passes it after a considerable time. There is often a persistent and painful hiccough after eating.

I must here mention that I have succeeded in producing this spasm of the œsophagus and cardia by cauterization of the pars prostatica urethræ in a physician, æt. 28, who had never had the spasms before. The affection developed immediately after the local treatment, and continued several days with such vehemence that the patient was only with difficulty able to swallow solid food.

Nervous Vomiting,

by which we understand that form which comes on without actual disease of the stomach, is, according to my experience, seldom met with as a reflex neurosis in diseases of the male sexual organs, and I have never observed those severe cases which Tissot described of "habitual vomiting, which resists all remedies as long as the patient continues his bad practices."

Since vomiting is a complicated action of various muscles, and since we know that the simultaneous occurrence of complicated movements is produced only from nervous centres, we assume that there is a special centre for vomiting. As a reflex vomiting in its narrower sense, we understand that form which is caused by irritation foci which affect other nerves than those which supply the stomach directly. Such irritation foci in high degree are the female genital organs, whose relation to reflex vomiting has long been recognized. The male genital organs are such in a much lower degree. There is no absolutely characteristic form which differentiates the nervous vomiting from the other sorts. The nature of vomiting is very different in different individuals. Some persons vomit easily, others vomit only after severe prodromal symptoms or not at all. There is a certain nervous peculiarity in the irregularity of its occurrence and cause.

As a rule, we diagnose nervous vomiting when a neuropathic individual is attacked with vomiting, which after the history and the physical examination, cannot be referred to a disease of the stomach, and when the vomiting is irregular and capricious.

At times nervous vomiting is a continuously present chronic trouble, and comes on without apparent cause. One of my patients, a merchant, æt. 30, who suffered at times with severe asthmatic attacks in consequence of masturbation and spermatorrhœa, felt very frequently nausea and an inclination to vomit, and vomited often without any special cause. He lost flesh rapidly. The first symptom of his improvement was the return of his appetite and the complete cessation of the nausea and vomiting.

In a second patient, a teacher, married, with marked sexual neurasthenia, the vomiting came on without preceding nausea, suddenly and mostly after excitement. He vomited always when he ate before taking a railway journey, and this purely from excitement, before he got aboard the train.

A third young patient with neurasthenia who had suffered, without self-abuse, from severe defecation spermatorrhœa since puberty, had lost his appetite (atony of the stomach), and on the slightest physical effort was compelled to vomit, no nausea preceding.

A fourth patient, æt. 32, a cashier, father of two children,

married for seven years, impotent for three years because of precipitate ejaculation, having frequent pollutions even in the daytime, had a regular morning vomiting with intense nausea, which ceased altogether as his sexual trouble improved.

Regurgitation

is the act by which at times, after eating, small quantities of stomach contents come up into the mouth. These are generally swallowed again at once.

If this only happens occasionally, the condition cannot be called pathological; it should be considered pathological, however, when the regurgitation is frequent and great quantities are brought up.

Even in this case the masses are usually swallowed again, being spit out only when they are strongly acid.

In the former case the regurgitation may make the transition form to "rumination," and there are cases where it is hard to draw the boundary line between them.

In general, regurgitation is a fairly rare symptom with genital affections in the male, and I have observed it but four times altogether, of which I give here one typical case. As in the case of rumination, we may consider the pathological basis of the affection to be an increased motor irritability of the stomach with occasional relaxation of the cardiac orifice.

Lorenz M., æt. 25, a large, uncommonly strong and robust peasant, was never sick up to his twentieth year. From that time on he complained of excessive fatigue; the appetite and the bowels began to be irregular. Often he has no passage for three or four days, and then several slightly diarrhœic passages in one day. He has very often a feeling of discomfort in the abdomen, a puffing-up and a sensation of fulness. The head is heavy in the morning; the patient always feels cold, and shivers at his work even in summer.

After a year the occasional diarrhœa ceased; the stools became again regular, not hard, but the bowels had so little energy that the patient became faint from straining.

About this time the regurgitation of his food began; for example, after the patient had taken milk, he was forced to throw up a mouthful or two, but without nausea or inclination

to vomit. The milk was generally sour. Other foods which came up into the mouth were swallowed again by the patient, since as a rule they were not sour.

This regurgitation of food continued and grew worse up to the time of the consultation, without disturbing the patient much, and it was not on account of this, but of a series of nervous symptoms, that he sought my advice. Besides the fatigue mentioned there was mental depression, and the memory had become so poor that the patient before coming to the physician had to note down everything that he wished to say, otherwise he forgot it.

For about three years, besides the mentioned shivering in summer, he had severe night-sweats in winter of the following nature: two or three times in the week, toward morning, the patient sweats so for from an hour to an hour and a half that the whole bed is wet. After this the patient feels ill and has palpitation of the heart. The attack is still more severe if he gets up when the sweating begins and so breaks it off.

For several years the patient has been obliged to pass his urine very often, getting up three or four times in the night. He has noticed that it does not pass in a stream as before, but merely falls and often dribbles afterward.

The patient cannot drink liquor. Wine or beer, even in the smallest quantities, make him quickly drunk, and give him a severe headache on the following day, which formerly was not the case.

The whole picture of the disease gave me the impression of being a neurosis, and the history which the patient gave confirmed this idea. The patient has masturbated since his fifteenth year. In late years the erections have been incomplete, and for some time the ejaculations have occurred without erection. The patient each time feels badly afterward. He had never attempted coitus. Nevertheless, he intends to be married and is in great anxiety for fear that he will be impotent.

The urine contains many semen threads. Local treatment of the genital trouble. Cure.

The surveyor Sch. offered also a good example of regurgitation.

Rumination or Merycismus

is one of the most remarkable of stomach affections, and has been known for centuries. Much has been written about this peculiar disease, and one of the first authors who treated of it, Joh. Conrad Peyer, of Schaffhausen, the well-known physician and discoverer of Peyer's patches in the intestine, published as early as the year 1685 a complete merycologia.

According to the latest investigations, it is caused by an insufficiency of the cardiac orifice with increased motor irritability of the stomach.

As to the chemistry of rumination, we know through the papers of Alt, Boas, and Jürgensen that hyperacidity, subacidity, or anacidity may be present. The chemical condition of the stomach is not an essential condition in rumination, which in most cases is dependent on an abnormal function of the nerves.

I have seen rumination four times as a reflex neurosis accompanying disease of the male genital apparatus, while I have never found it in the large number of cases of female disease which I have seen. I give here one of the typical cases.

R., age [illegible], comes from a very nervous family, in which eccentricities of character, nervousness, hysteria, various neuralgias, and mental diseases are frequent. Apart from a tolerably severe [illegible] his [illegible] year, he was healthy up to his sixteenth year, at which time he went into business. He ascribed to the continuous sitting at his desk the digestive disturbances which gradually came on, consisting of pressure in the epigastrium, vomiting and eructations. Together with these there is heaviness in the head, sleeplessness, almost constant pain in the back and general fatigue. The appetite is [illegible]. Some time after the eructations became more violent [illegible] instead of simple air. There is never [illegible]. When he has eaten [illegible] after [illegible] has [illegible] swallowed by the [illegible] hours after a meal, the food has [illegible] the tongue. It is [illegible] stomach is so sudden [illegible] when speaking, [illegible] the food is [illegible]

from his mouth like a ball from a cannon. If the patient lies on his right side when in bed, no eructations occur, but there is a dull pressure in the epigastric region. If he lies on the left side, eructations of wind immediately begin, followed by food. This continues often until midnight. Many nights he does not sleep. Since this condition became unbearable to the patient, and he and his physicians believed the cause of it to lie in his mode of life, on the advice of his physicians he turned his attention to agriculture. But since the improvement after some years was not as great as was expected, he again took a position in a business company, in which he remained until his twenty-seventh year. His general condition during this period was very distressing; the old symptoms have continued and new ones have developed. The eructation of wind and food has become regular and occurs after every meal. It is especially troublesome at noon and in the evening. If he lies on the back or right side, after eating, the trouble does not come on. He can also prevent it by reading an interesting book or by drawing, which is his favorite pastime. Pleasant company has also a favorable influence. If the patient goes to walk alone after eating the eructations occur every few minutes for three or four hours. The company of one friend renders his condition worse, since conversation fatigues him. If, however, a number of friends are with him, he feels much better.

At the height of his trouble the patient noticed a temporary heaviness of the tongue which came on one or two hours after breakfast. Up to this period of the day he is well disposed and tries to finish his hardest work at this time. He begins then to feel depressed and the tongue grows heavy; he is not able to pronounce long words at all, and even those of few syllables are difficult. It is impossible for him to think at this time; he can only perform the most routine mechanical work, and would consider himself incapable of work if he did not know that his condition was chronic. The sense of smell is very much affected; often the patient cannot smell at all, and often he has hallucinations of smell of an indefinite and exceedingly unpleasant nature. The taste is also weakened, and he has no perception of that which he eats. The hearing is bad, and he must often be spoken to twice. As his condition becomes better, a dreamy state of the mind comes on; he has a flood of ideas without association. Things appear to

him which he believes he has experienced, and in the next moment he realizes that they have never happened. A cup of strong tea or coffee improves him considerably, while wine always renders his condition worse. The symptoms are never so marked in the afternoon as in the morning, nevertheless in going home in the evening his friends have often thought him intoxicated on account of his stuttering speech. Later, to the previously described symptoms was added that of writer's cramp.

He gave up business. Dietetic treatment, a stay in the mountains, and sea baths brought no improvement. When the patient came to me his condition was about as described. He cannot eat vegetables or desert, and throws up large quantities of a very sour fluid several times a day; he carries always a box of bicarbonate of soda with him, which he takes as occasion requires. My therapy consisted, besides a careful regulation of the diet, in the washing out of the stomach twice a day with Carlsbad water. No improvement.

The failure of the different treatments and the excessive nervous symptoms led me finally to the idea that we had here to do with a severe neurasthenia, and that the rumination and the other symptoms on the part of the stomach were but symptoms of this disease. In seeking the cause of his disease, I discovered a spermatorrhœa in consequence of long-continued and still practised masturbation. He had never had coitus.

My diagnosis was then: Severe sexual neurasthenia, the principal symptom of which is the rumination. The sexual neurasthenia is here caused by the hereditary infirmity, the long-continued masturbation, and the result of the latter, the spermatorrhœa. The patient, who struggled against his evil habit, was treated locally for his sexual disease. The neurasthenic symptoms begin to be less marked, and the rumination as well. Under long-continued careful treatment the entire trouble disappeared. The patient married and has remained in good health.

With the expression

Peristaltic Unrest, Tormina Ventriculi Nervosa,

Kussmaul designated an excitable condition of the stomach, in which the peristaltic movements became more apparent than usual and were distinctly seen and felt.

I have seen but one case, an Italian, æt. 17, who had practised onanism for years, in which at the same time there was excessive peristaltic movement of the digestive tract. If the peristaltic unrest of the stomach became marked, it sometimes caused vomiting.

From their frequency, among the motor neuroses in consequence of sexual anomalies a principal rôle is played by

Cramps of the Stomach (Gastralgia).

These are produced by the morbid contraction of the stomach, which the patient describes as a feeling of compression or of squeezing. In severe cases the pain is so great that the patient cannot remain standing, but must lie down, and a feeling of threatened fainting comes over him. Although these cramps arise from an entirely different cause, they are often placed with the gastralgias, since the latter are also accompanied by severe pains, which, however, have a quite different character, being more of a boring or sticking nature. I have seen these cramps of the stomach, arising as reflex neuroses from the male sexual organs, in a great number of cases, and this form appears to me so characteristic, the picture of this neurosis so sharply drawn, that I am surprised that attention has not been previously called to it.

The diagnosis of this affection of the stomach is in most cases not difficult, and I believe that one should be able to make it at once, if he had once seen such cases. The pathognomonic feature of this neurosis is—besides the character of the pain already mentioned—the time of its appearance. The pain seldom or never appears during digestion, but as a rule only when the stomach is empty—*i.e.*, some hours after a meal. The patient is often awakened after midnight by the pain, or it may be most severe at four or five o'clock in the morning. Only in very marked cases does the pain come on inside an hour after the meal. The nature of the food taken has but a slight influence on the development of the affection. The patients say only that generally the more nutritious foods, such as eggs and meat, are better borne. We have already spoken of the character of the pain; it has not the least similarity to the feeling of hunger; there is, as a rule, no nausea or inclination to vomit; on the contrary, a feeling of

emptiness and faintness. Characteristic and of diagnostic value is the manner in which patients often free themselves from the pain, viz., by eating or drinking. The majority discover this means, although a feeling of hunger is never present. It is generally sufficient to bring anything into the stomach, be it only a glass of water or a bit of bread, and the painful gripings and contractions in the stomach disappear. The best means is, however, the swallowing of a glass of good red wine and a piece of roast meat, after which a feeling of relief and of comfort comes on. In many cases the diagnosis is rendered more difficult since other gastric symptoms are present; most frequently there is a secretory neurosis consisting in the secretion of very acid stomach juices. Physician as well as patient is then often led astray and regards the cramps as secondary to the stomach acids, while in fact both affections exist together, and both are co-ordinate and dependent on the genital disease.

The appearance of the patients is generally bad; they look pale; they are lean and complain of various other symptoms, among which the gastric symptoms always take chief place. At times, however, when the genital disease is not severe and the patients are in good circumstances, their appearance in the beginning of the disease is very different; they are heavy and fat in consequence of the increased amount of nutrition which their disease has compelled them to take.

Lallemand describes this condition in the following words: "They continue to eat and even more than ordinarily, whether, etc., . . . or whether a real feeling of the need of food masters them. The sensation experienced in the latter case is not precisely that of ordinary hunger—it is a species of gnawing, of heat referred to the epigastrium; it is a sense of discomfort, an agony which almost causes faintness."

In order to illustrate this affection practically, I give here two

Histories.

Case I.—M., æt. 34, watchmaker, a chronic masturbator of anxious, cachectic appearance, who even in the day-time with various efforts, as coughing, etc., has pollutions without erection, consulted me on account of an unusually severe grip-

ing pain in the pit of the stomach, which at times becomes so severe that the patient must lie down; at these times he is weak and feels faint. These pains come on mostly mornings about nine o'clock, evenings before supper, and very early in the morning before breakfast. As soon as the patient takes something, be it only a drink of water or a bit of bread, the pain ceases suddenly. This has no similarity to the feeling of hunger. The patient has no desire to eat, and does this only since he has learned to stop the pain in this manner. The appetite is normal, the tongue not coated.

The local treatment of the sexual disease quickly cured the stomach affection.

Case II.—G., æt. 30, farmer, strongly built, but now lean and of anæmic appearance, was until a few years ago a nurse, which occupation he gave up on account of a chronic stomach trouble. For about six years he has felt mornings, fasting, a painful griping in the pit of the stomach; at times this awakes him in the night. The pain ceases as soon as he eats; it gradually began to come on in the day, but always two or three hours after eating, and always ceased again as soon as the patient swallowed anything. In time the trouble came on more frequently, lasted longer, and was more intense. Before the patient came to me the pain lasted often the entire day, excepting meal-times and an hour after. He was often awakened at night by the pain. Lately, at the times when the griping comes on, there is secreted a quantity of acid fluid in the stomach, which is vomited. General fatigue, palpitation of the heart, headache, frequent urination, irregular bowels. Very little sexual desire. The infrequent coitus is unsuccessful on account of incomplete erection. For two years the patient has noticed after urination the passage of some drops of tenacious matter, which he believed to be semen, and which the microscope showed to be such. The cause of this is long-continued masturbation. Since the medicinal treatment had been unavailing, I proceeded directly to the treatment of the sexual trouble and the patient was soon cured.

Case III.—W., æt. 21, student of Greek, anæmic and lean, consulted me on account of a stomach trouble of three years' duration. The patient when he has fasted for some time gets a griping pain in the gastric region. As soon as he has eaten,

the pain ceases. The tongue is red, the appetite excellent; there is never nausea or vomiting, but great fatigue and sleeplessness. The patient lives very regularly, does not smoke or drink spirituous liquors.

He has masturbated from his thirteenth year and now has spontaneous pollutions at night. The patient states that often after a pollution he has a severe burning pain for a moment in the prostate. He notices often with urination or defecation a mucous cloudy passage from the urethra, which is followed by greater depression than a pollution. The mucous matter passed is shown by the microscope to be semen. Local treatment of the genital disease. Quick disappearance of the stomach trouble.

Here belongs also the history which I shall give later under the head of the secretory neuroses.

B. Sensory Neuroses.

The sensibility of the stomach is usually slight and in normal conditions we are unconscious of it; for we feel neither the temperature of the foods introduced into it, nor their chemical reaction, nor their weight, nor the place where they lie.

We feel the fulness of the stomach only when this is excessive, and this is to be attribtued to the stretching of the stomach walls.

The healthy stomach has but two sensations, that of hunger and that of satiety, while the diseased stomach is rich in disagreeable and painful feelings, and richest with those forms of disease in which there is no actual change in the stomach, but merely a change in its sensory nervous apparatus (Oser).

We suppose, after Schiff, that the sensory nerves for the stomach run in the course of the vagus. After section of the cervical portion of the vagus, the pylorus, which is the most sensitive part of the stomach, can be pulled about without any feeling of pain being experienced.

It is also probable that the sympathetic fibres which go to the stomach from the cœliac plexus contain sensory fibres.

Among the anomalies of sensation of the stomach which depend on diseases of the sexual system, I include also the

altered influence which certain foods may exercise on the stomach nerves.

In a great number of my cases, the patients state that small quantities of wine or beer cause them a severe headache, which had not been the case before.

It is the same with smoking. Persons who were excessive smokers complain that this now causes them dizziness, heaviness of the head and disturbance of the stomach, and they have been forced to give up the habit altogether or in part.

I mention here as a curiosity the statement of Boerhaave, that in young persons in whom sexual excitement has arisen to a certain degree a pleasant sensation in the stomach occurs; but when they satisfy their desires in too great measure, a nauseous and uncomfortable feeling in the stomach comes on: "Stomachus delectationis tristitiæque princeps est" ("De morb. chronic.," I., II., c. VI.).

M. Payva, a Portuguese physician, says similarly: "In tentigine ardentissima juvenum inest quid grati in ore ventriculi; in concubitum si ruant salacissimi, et ultra vires tendant opus, tunc in ore ventriculi manet illud ingratissimum amarumque, quod exprimere nequeunt."

By

Anorexia (ἡ ὄρεξις, a craving)

we understand the want of appetite and feeling of hunger, and not according to the narrow meaning of the word the absolute want, but the whole scale from a gradual diminution of the appetite up to its complete cessation. Anorexia is a very frequent symptom of all neurotic diseases, which should not surprise us when we remember that quite transitory disturbances of the nervous centres, as, for example, overwork, may completely do away with the desire to eat; even the depression of the spirits from grief or sorrow, or the continuous fixing of the attention on a special idea, may take away the feeling of hunger from the sensory nerves of the stomach (Stiller). Anorexia in its various forms is, therefore, a frequent symptom in sexual neurasthenia. "I feel no desire to eat," say such patients; "I eat only to keep myself alive and because others do it." I hold this affection—like Stiller—to be an anæsthesia of the gastric nerves.

As an example of the common form of anorexia, I give the following history:

A., æt. 34, merchant, a thin, badly-looking man, consulted me on account of a severe chronic spinal irritation with melancholy, with which he suffered in consequence of a defecation spermatorrhœa. Years before the patient lost the feelings of hunger and appetite completely; he eats only to keep himself alive and is quite indifferent as to what he eats. There is no pain in the stomach, and only after pollutions without erection, or after considerable loss of semen with defecation, has he nausea and vomiting which may last all day.

In other cases the anorexia is temporary, comes on only after special causes, and disappears completely after a longer or shorter time, to recur at another occasion. So, for example, A. L., æt. 20, strongly built, with whom after an act of onanism a severe neuralgia of the testicles comes on, and a griping in the abdomen followed by diarrhœa. For two or three days after this the patient has no appetite and can only take liquid food; all solid nourishment causing nausea and vomiting.

This affection is easily confused clinically with atony of the stomach, and in many cases we may scarcely be able to differentiate between them, since the chief characteristic, the more or less complete absence of the feeling of hunger, is the same in both. The differential points are as follows: In atony, often at the time when the feeling of hunger should come on, the patient has a feeling of emptiness which disappears after food is taken. Further, in many cases we find the symptoms of slight dilatation, and may discover by means of the stomach sound that digestion is retarded. All these symptoms are wanting in anorexia, but another symptom is often present which is of diagnostic value. This is acoria, or wanting sensation of satiety.

Nausea

before eating is considered by some authors as the highest degree of anorexia. The former affection is, indeed, for the most part found only in connection with the latter. The nau-

sea is caused mostly by certain forms of food, especially meat; it can be caused, however, by any solid food. The nausea may be a chronic affection, or come on only after special causes. The latter are mostly pollutions with erection, great loss of semen at the time of a passage of the bowels, or of coitus reservatus. The nausea in this case comes on quickly and can last a few hours or one or two days. A good example of this is the case A. L., in which, after each act of masturbation, neuralgia of the testicles, faintness, and complete loss of appetite came on. The latter is connected with nausea produced by every form of solid food, so that for two or three days the patient could take only liquids.

The nausea may be constantly present for a long time, and then completely disappear. I would refer here to the case cited in the section on bulimia, in which a peasant with marked sexual neurasthenia had nausea produced by every form of solid food, alternating with a voracious appetite.

The affection may, however, have a chronic character. Such a case was described in my paper on nervous coryza and flow of saliva and their etiological connection with diseases of the sexual apparatus ("Münchener med. Wochenschrift," Nos. 3 and 4, 1889). The teacher K. who suffered from great loss of semen, felt regularly for a long time a marked nausea produced by every solid food.

Acoria,

i.e., lack of the feeling of satiety, which also seems to me to depend on anæsthesia of the nerves of the stomach, is, as stated above, very frequently found with anorexia. The clinical picture, as an example of which I give one case, is as follows:

W., æt. 23, student of theology, a thin, anæmic man, who on account of severe sexual neurasthenia had given up his university studies, consulted me. The patient, a very gifted man, had lost his memory and his intelligence altogether. His whole being is relaxed; he is most of the time in a dreamy state and interests himself in nothing, but is completely apathetic. His appetite is gone. He never has a desire for food; if he comes to the table he eats on as long as anything is left, or until he attracts attention, and this for the reason that he never has

a feeling of satiety. He has no discomfort after eating. He is so constipated that unless he resorts to artificial means, he goes for two weeks at a time without a passage. His sexual disease consists of unusually frequent nocturnal pollutions, which may be brought on in the day-time also by looking at lascivious pictures, etc.

The acoria may also exist together with the normal feeling of hunger.

B., æt. 25, bookbinder, having severe sexual neurasthenia, suffers from sleeplessness, weakness of memory, mental depression, constipation, and irritable bladder. The appetite remains good; it is often excessive and voracious, and the feeling of satiety is altogether lost. Not even after the heaviest meal has the patient the feeling of pressure or discomfort.

I will remark that the acoria was cured in both these cases as the symptom complex of the sexual neurasthenia began to disappear with the treatment of the genital disease.

Acoria, or the want of the feeling of satiety, cannot be confused with bulimia, or the canine appetite, since it lacks the chief factor of the latter, the impetuous and painful craving for food.

The peculiar acute or chronic

Canine Appetite (*Bulimia, Cynorexia*),

which I have often observed in diseases of the female sexual organs, was found very seldom in a marked form in diseases of the male sexual organs, especially if I take into account only the forms which possess the specific, characteristic, painful feeling of hunger. We find very often an appetite voracious at times, which is also pathological. As an example, I would cite the case of the bookbinder B., given in the section on acoria.

Lallemand says of this condition: "In the beginning, venereal excesses are ordinarily accompanied by an increase of appetite, in consequence of the need that the economy has of supplying promptly its daily losses, and of the new excitation

which the genital organs cause; masturbation produces in the beginning analogous effects; it causes sometimes a sort of voracious, insatiable bulimia which is almost brutal."

As I have said, according to my experience, the occurrence of this with diseases of the male sexual organs is fairly rare. I have given an example under rumination, in which the ruminating patient had occasionally a canine appetite.

Another case, which I give here briefly, represents the typical picture of a chronic canine appetite, as I have observed it in consequence of sexual anomalies. It resembles the description that Lallemand gave of this affection.

S., æt. 28, sexton, unusually muscular, consulted me on account of severe pain in the back, general nervousness, and weakness of the genital organs. Although he has been engaged a long time, he is afraid to marry because of this affection. Up to his tenth year he was strong and healthy; at this time he began to masturbate.

When he was sixteen years old he had swelling and tension in the stomach after eating. His passages were always diarrhœic. After this trouble had lasted about a year, a painful canine appetite came on. He often waked in the night and felt forced to eat whatever he could lay his hands on. He is awakened in the morning by this painful sensation, which is generally associated with nausea. The patient eats very often in the course of the day whatever he can find, in order to still this fearful hunger. He only feels comfortable when the stomach is as full as possible. This morbid condition had not altogether left him at the time of the consultation, and came on most readily when the patient lived irregularly or smoked much. Especially in the beginning, and now at times, these attacks of canine appetite are accompanied by a rolling in the abdomen, and the patient believed so surely in the existence of a tapeworm that he put himself under treatment for this, which proved conclusively that there was no tapeworm.

I have observed but one case in which, in a peasant æt. 36, with severe sexual neurasthenia, there was complete loss of appetite with nausea alternating with canine hunger.

The feeling of

Emptiness

is found comparatively often with anomalies of the male sexual organs.

It is found at times in place of the natural feeling of hunger, *e.g.*, in atony of the stomach, where it ceases as soon as food is taken.

It is also found in cases of bulimia and sometimes directly after morbid loss of semen—*e.g.*, after pollutions without erection in the daytime, etc.

Nausea

is often observed with diseases of the male genital system. It is generally found in conjunction with other affections of the stomach, such as canine appetite as in the case cited, where the patient was awakened mornings by the bulimia associated with a feeling of nausea.

The reflex vomiting often commences with a feeling of nausea, although this is not always the case. Nausea comes on at times by itself, after morbid loss of semen. One of my patients, B., æt. 34, merchant, who suffered from spinal irritation and incomplete anorexia in consequence of defecation spermatorrhœa, had nausea which sometimes lasted all day, after every pollution without erection, and often also after marked loss of semen with defecation.

M., æt. 37, Catholic priest with sexual neurasthenia, was attacked several times a day by a sudden transitory nausea, especially at meal-time. At table the patient suddenly feels inclined to vomit, and then has an attack of fainting. These symptoms recur four or five times in the day.

Nervous Dyspepsia.

In the third volume of his work, "Des pertes séminales involuntaires," Lallemand has given an excellent description of a reflex neurosis of the stomach caused by the condition above mentioned. "The repast is not followed by that vague and expansive feeling of well-being which produces the restoration of the economy; on the contrary, a certain heaviness soon

manifests itself in the epigastrium, extends to the neighboring parts, and causes a malaise, a disquietude which forces the patient to move, to change his position; the pulse increases in rapidity, becoming at times even tumultuous; the face becomes flushed rapidly; there comes on a vagueness and confusion of ideas, giddiness, ringing of the ears, vertigo; in fine, the symptoms of congestion."

The French author has here described the symptom complex to which Leube gave the name of "nervous dyspepsia." As every one knows, says the latter, in many patients the digestion exerts no little influence on the general condition. After a heavy meal there is fatigue, general discomfort, and the feeling of fulness. These nervous symptoms of digestion may pass the physiological bounds and become morbid. In this manner a chronic trouble may finally develop whose cause lies in the abnormal reaction of the nerves of the stomach in stomach digestion, for the process of digestion is exactly as in healthy persons; it is not pathologically delayed and the chemical products are normal, as may readily be seen by washing out the stomach. The pathological basis of this affection must lie in a hyperæsthesia of the nerves of the stomach.

The diagnosis rests on the symptoms given above, on the exclusion of other diseases of the stomach, and finally on the examination of the contents of the stomach. The existence of other nervous symptoms at the same time, such as neuralgia, etc., is of importance. As to the histories, most of our cases show anomalies of the genito-urinary system.

As an example, I give one history previously published in my "Diarrhœa Chronica Nervosa:"

M., æt. 26, merchant, consulted me in the fall of 1878 on account of a so-called chronic stomach and intestinal catarrh, from which he had suffered for a year. The patient is tall, thin, and pale; he has a fair appetite; soon after eating, however, a feeling of fulness and tension in the epigastrium comes on; the head becomes heavy; general fatigue, weariness, mental depression; palpitation of the heart. Several times a day he had loose passages. The trouble not yielding to a medicinal and dietetic treatment, I examined the patient carefully. Chemical tests had never shown anything abnormal in the

urine. The microscope, however, showed casts and semen threads. I had here a spermatorrhœa with the so-called testicle casts, which I had never found before. Being told of the frequent finding of semen in his urine, the patient confessed to frequent masturbation in youth. He had never attempted coitus. The treatment was directed entirely to the spermatorrhœa, which being cured, the other troubles vanished. The patient is now married and has several children; he is still in good health.

I have described another extraordinary and interesting case in Vol. VIII., No. 1 of this series—"The Urine in Neurotic Diseases." This depended on a frequently-practised coitus reservatus.

In general we may say that nervous dyspepsia is not a frequent symptom of sexual diseases in the male, and that severe forms are especially rare.

C. The Secretory Neuroses of the Stomach.

are the most frequent of the reflex diseases of the stomach, and were described long ago by the French and English authors, Lallemand, Trousseau, Pemberton, Copland, etc. Lallemand wrote: "On one hand the acid regurgitations, the sharp gnawing feeling of heat in the epigastrium, a sort of pyrosis, etc., indicate how vicious digestion is."

This condition has been investigated with our present methods by Reichmann, Jaworsky, Rieger, etc. Its connection with anomalies of the female genital organs has been much studied.

Kretschy showed on a patient with fistula of the stomach that there is a regular scale of acid formation in the stomach during the process of digestion. About an hour before stomach digestion is ended the acidity is at its maximum, and from then rapidly decreases until the stomach contents become of neutral reaction. This normal acid curve changes as the menses come on, and during the whole course of menstruation the stomach contents have never a neutral reaction. The normal relation returns as the menses cease.

This is a striking proof that the secretion may be influenced in a reflex manner by the most distant processes, especially, however, by changes in the sexual organs.

Rosenthal gives two forms of stomach disturbance caused in a reflex manner from the female sexual organs:

First group: In consequence of increased irritation of the secretory gland apparatus, there is a copious secretion of too acid gastric juice, which increases the power of digestion. The affection causes, however, when food is taken, an intense subjective disturbance in the stomach.

The condition of gastric irritation reveals itself, according to Jaworsky, by the appearance of numerous lymphoid cells in the contents of the stomach, and is followed by mechanical insufficiency.

Second group: In consequence of the exhaustion of the secretory glands of the stomach, the formation of acid almost ceases, and mucous cells are found in the stomach in place of lymphoid cells.

The hypersecretion of gastric juice may be divided into a periodic and a continuous form. Increased acidity is present in the latter, but not, as a rule, in the former. The periodic form comes on mostly after eating, seldom when the patient is fasting; it would not seem, however, to depend directly on the taking of nourishment.

The continuous hypersecretion consists of the steady production of a very acid gastric juice, so that even in the fasting stomach a varying quantity of fluid similar to the usual secretion is found. The irritation which the acid fluid produces on the mucous membrane leads to acid eructations, acid vomiting, gastralgia, etc. The tongue, however, is generally clean; the appetite is not diminished, but rather increased.

A clue to the proper diagnosis is given by the fact that the disturbances cease temporarily after albuminous food is taken. This is a differential characteristic between these and the disturbances in pyrosis and gastralgia in consequence of acid fermentation.

It is thus proven that the female genitalia may cause a reflex secretory neurosis of the stomach, and this not infrequently happens. According to my experience, this is just as frequent in consequence of anomalies of the male sexual organs, and I have observed a series of these cases, which are clinically of great interest and allow no other explanation. A number of the cases described by Rossbach under the name "Gastroxynsis" would seem to be due to sexual anomalies.

Rossbach's description is as follows: The disease, which affects adults chiefly and for the most part those who are subjected to a continuous mental strain, comes on every week or perhaps less frequently, and lasts from one to three days. The attacks are the more frequent the greater the mental application; they cease in the holidays, to come on again when the patient returns to work. In the intervals the patient enjoys perfect health. The attack begins either with a severe headache or with a distressing feeling of burning in the stomach, afterward followed by headache. The attacks come on fasting and when the stomach is full, and the symptoms often become very severe in the course of a quarter of an hour. The feeling of acidity in the stomach is very perceptible; the patient has a feeling of gnawing in the stomach. This feeling is at times so strong that it prevents sleep. This same acidity seems at times to cause a reflex closure of the pylorus. The headache comes either earlier or at the same time, or perhaps later. The feeling of nausea usually leads to vomiting. This and the headache cease only when the stomach has been completely emptied. The vomited matter is exceedingly acid, and chemical analysis shows a considerable increase of hydrochloric acid; after vomiting the headache ceases, the patient falls asleep, and awakes feeling perfectly well again. The attacks may often be stopped when the acid feeling is first felt, or as the headache begins, by drinking lukewarm water.

Rossbach supposes that under certain conditions on the one hand, from certain centres partly directly, partly reflexly, an abnormally strong gastric secretion is produced; and that on the other hand, from the action of the acid on the sensory nerves of the stomach, much more violent reflexes may be produced in distant parts than when the nervous system is in its normal condition.

I give here a typical case:

M., æt. 34, farmer, has been married ten years and is the father of three children. Though formerly in good health, he has lately complained of mental depression and pain in the stomach. This latter was experienced only when fasting, and quickly disappeared on taking food.

The patient was careful never to have his stomach entirely empty. These stomach pains have been more violent in the last two years.

There is a burning pain at a localized spot in the stomach not larger than a silver dollar. This burning comes on regularly an hour or an hour and a half after eating, no matter what the patient has eaten. This burning is soon followed by a rolling, after which a watery gastric secretion comes up and runs for hours from the mouth. After this the patient feels exceedingly uncomfortable. The appetite is always good, but the general condition has been bad for the last year. The patient, previously strong, is emaciated, pale, and anæmic; severe headache, sleeplessness, melancholy, continuous desire to urinate. A regular dietetic treatment, with the daily washing out of the stomach with Carlsbad water, caused no improvement. His intelligent wife called attention to another point. Since the beginning of his married life he has been sexually weak, and has had little desire for coitus; his ejaculation is precipitate, and after every act he is ill for several days. The patient confessed that he had masturbated frequently from his fourteenth year up to the time of marriage, and that for years he had noticed the passage of cloudy drops after urination. The microscopic examination of these drops shows the existence of micturition and defecation spermatorrhœa. The cure of this by means of local treatment restored the patient completely, and the stomach trouble disappeared without special treatment.

Examples of hypersecretion of a strongly acid gastric juice have been seen in the case of rumination, in which the patient combated the affection by taking quantities of bicarbonate of soda many times in the day, in the case of eructation given on pages 482 and 483, and in Case II., page 495.

As to the frequency of nervous troubles of the stomach with chronic affections of the male sexual organs, we may say that these are among the most frequent symptoms of sexual neurasthenia, and that they are exceeded in frequency by but one symptom of this disease, viz., spinal irritation.

This accords with the view of Curschmann, who considered nervous diseases of the stomach among the most frequent symptoms of disease of the male genital organs. Those forms of nervous stomach troubles which we regard as caused reflexly by disease of the genital organs form a very considerable percentage of all the nervous stomach troubles in the male.

As to the manner of their development, we seldom find one of the various forms of nervous stomach trouble by itself; in the majority of cases several are observed together, as, for example, anorexia (want of the feeling of hunger) and acoria (want of the feeling of satiety), or eructation and rumination, or cramps and hypersecretion of acid juices, etc.

We have often seen one affection disappear and another take its place; for example, after flatus has existed some time eructation comes on, and thus is followed by regurgitation, and the eructation and regurgitation or flatus and regurgitation may exist together at the same time.

The nervous stomach troubles may also alternate with other neuralgic affections or even take their place.

I would refer here to the case reported in which cramps of the œsophagus and the cardiac orifice appeared occasionally in place of a severe migraine. In another case I found that a chronic neuralgic pain in the arms ceased suddenly, and an acute canine appetite developed in its place.

In a third case of very chronic sexual asthma the affection disappeared suddenly at times, and in its place came nervous stomach troubles of various sorts; then sudden disappearance of the latter and return of the asthma.

As for the affections themselves, the most frequent are atony, moderate flatus, anorexia, and cramps. The others, such as eructation, are met less frequently.

The most rarely found are peristaltic disturbance, nervous vomiting, and rumination.

The nervous diseases of the male have many peculiarities not found in those of the female. The first difference is the relative frequency of certain forms in the two sexes. Severe eructation is found very often in the female; nervous vomiting and chronic cardialgia are often the result of uterine disease.

The two former affections are comparatively rare in the male, and according to my experience, cardialgia is never found. On the contrary, the cramps which come on when the stomach is empty and pass off after taking food are peculiar to the male. These cramps are a neurosis peculiar to genital anomalies, and must be distinguished from genuine cardialgia.

As to the therapy, we need only say that this is not to be a local and specific treatment of the stomach, but treatment of the general condition of the nervous system and local treatment of the genital disease.

PRACTICAL GUIDE

TO THE

DEMONSTRATION OF BACTERIA

IN ANIMAL TISSUES.

BY

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VIII—33

DEMONSTRATION OF BACTERIA IN ANIMAL TISSUES.

CHAPTER I.

PREPARATION OF THE SECTIONS.

As it would be quite impossible to answer in any detail the frequent inquiries which have been made of me from time to time upon the subject of the best method of demonstrating bacteria in the tissues, I have determined to publish in the following pages a short *résumé* of the methods which I have lately used in making bacteriological preparations, as well as an account of the complete technique; of course, it being understood that the methods here described cannot be spoken of as settled once and for all.

The difficulties which I myself had at first to overcome in this department were considerably increased by the want of a guide which entered fully into the detail of the procedures. As such a guide has not up to the present time appeared, I think I may render service, especially to those who have only just entered upon this field of work, by furnishing an exact and detailed explanation of the technique employed, together with the description of the methods, which would enable anybody to perfect himself therein without a great loss of time. The very numerous publications on the methods of staining render it all the more difficult for the beginner to make a proper selection, and at any rate very much time and trouble are required for the purpose. It must, therefore, be useful to him to possess such a guide as will enable him in the shortest possible time to obtain his principal aim—that is to say, to be able to demonstrate all the well-known micro-organisms in animal tissues. Later on it will be his business, by compar-

ing these with other methods, to attain to an independent judgment, and with this knowledge he will be able to commence investigations upon his own account.

In order to render this guide as practical as possible, I have excluded all theoretical considerations, and have restricted myself to the most essential points. I have also only directed detailed attention to the three nuclear staining dyes, viz., methylen blue, fuchsin, and hexamethyl violet, since they are perfectly sufficient for the demonstration of all the at present well-known bacteria. I always endeavor to preserve the tissue as much as possible intact, and so I prefer to use as a means of removing the first dye, solutions of other dyes, or when this is not possible, weakly acidulated water; while alcohol is restricted as much as possible to purposes of dehydration.

I would especially direct attention to a few apparently insignificant modifications of the hitherto employed methods—*e.g.*, the lifting up and spreading out of the sections on cover-glasses (avoiding the use of filter-paper), and thus transferring them to the slide. This procedure not only saves time, but also avoids the risk of the introduction of foreign impurities.

The formulæ for making the composite stains are inserted at the end of the book as a separate chapter, in order not to burden the text with the description of the methods of preparation, and to make their preparation clear and simple.

No one wishing to undertake the microscopic bacteriological examination of tissues can do so without a microtome of some kind. The choice of a microtome is not an easy one. I myself have entirely passed over the larger and more complicated kinds, and have adopted one which is simple but at the same time solid—*i.e.*, the freezing microtome of Katsch, of Munich (see Chapter II.). It is arranged for cutting sections of tissues imbedded in different ways. As this instrument has been sufficient for me for years, I will not presume to pronounce any opinion upon others. I should, however, like to say that the chief thing will always be to have a complete mastery over whatever instrument one adopts, and not to be too apt to ascribe failures to the fault of the instrument employed.

With regard to the various ways of imbedding the material to be cut, I have after various trials of other methods always returned to that of freezing (see Chapter II.), because

it is indisputably the simplest and because it is quite sufficient for our purpose, especially after one has overcome the first technical difficulties of its use and has comprehended the reason of the failures frequently occurring in the hands of beginners.

It is always of advantage to harden the material (see Chapter II.) in which the micro-organisms are to be demonstrated first of all in alcohol, according to the usual methods, that is to say, when this is possible. If we have to do with parts of the central nervous system which have been hardened in preparations of chromium, the hardening reagent must be thoroughly extracted from the tissue before cutting.

The method of cutting fresh material without preliminary hardening is to be used only in those cases where a very rapid preliminary diagnosis is required. The sections in such a case must be placed, after having been cut, in 0.75 per cent saline solution, and must be transferred from it upon a properly bent platinum spatula or section lifter into absolute alcohol for dehydration and hardening—a proceeding which requires practice and patience for its proper accomplishment on account of the shrivelling of the section which most likely occurs.

If, however, the material used has been thoroughly hardened before cutting, the difficulties in making the sections are much lessened. A preliminary hardening of the material then is presupposed in the following remarks upon the use of the freezing microtome.

Use of the Freezing Microtome.

After the hardened material has been divided into pieces of about 2 mm. thick and not more than 10 mm. long, it is necessary to place as many of them as are to be cut at one time in a large basin of water, to remove the alcohol.

If the temperature of the water in which they are placed is about 30° R., the extraction of the alcohol takes place more quickly, so that the pieces are ready for freezing and cutting in an hour, whereas if cold water is used, three or four hours at least are required for the thorough removal of the spirit. Unless the alcohol is thoroughly removed, the freezing is difficult and the thawing is so quick as to allow hardly any time for the cutting. The material when placed upon the plate of

the microtome should present if possible an angle to the edge of the knife, and should be pressed down with a small weight. The margins should be moistened with water by means of a long-handled camel-hair brush, and the moisture should extend for some little distance around the specimen to be cut, in order that the exact moment of freezing and thawing may be observed. It is essential to apply the ether spray so exactly that too low a temperature, whereby the material is rendered too hard for cutting, is not reached; for only just below the thawing point is the temperature such that the consistency of the material is fit for cutting. This point is attained by the following method: First of all one allows the spray to play upon the under surface of the plate until the material is firmly frozen on to it, and then removes the weight. One then waits patiently until the water which surrounds the tissue upon the plate as a control thaws, after which so many jets (5 or 6) of the spray are applied as are necessary for the complete freezing of the material. They are repeated as often as may be required until the whole thickness of the material is properly frozen, of which one can easily satisfy one's self by the application of a needle. After regulating the position of the plate, one takes hold of the metal block to which the knife is fixed at an angle of 45°, moistens the upper surface of the knife with water by means of a camel-hair brush, and first of all cuts a smooth surface. If the knife slips over the material without cutting, the failure depends either upon the position of the plate or upon the material having been frozen too hard. In the latter case it is sufficient to slightly moisten the surface of the material with the brush in order to remedy the defect and so to make the specimen fit for cutting. A failure is apt to make one believe that the plate is too low, and very often induces one to screw it up further, and too thick sections result. When cut the sections generally roll up and lie upon the upper surface of the knife. They should be lifted off from the knife with a brush and placed in water in a small basin. This ought to be done with each individual section if it hang down over the edge of the knife to the slightest extent, but if not the section which follows pushes the preceding one farther up the knife, and in this way it is possible to make a whole series of sections quickly one after the other, and one may transfer them with one sweep of the brush into water, which

must be done as soon as the last section comes to lie over the edge of the knife. While the right hand manages the knife and the brush, the left attends alternately to the raising of the plate and to the spray. To regulate the latter properly is one of the most difficult but at the same time one of the most important parts of the whole process, as one sees if one has attained to a proper comprehension of the fundamental condition of success—*i.e.*, the attaining of the proper degree of cold for cutting the material. As soon as the water upon the plate begins to thaw, three to five jets of the spray suffice to freeze it again and to make further cutting possible. It certainly requires some practice to direct one's attention not only to the cutting, but also to the degree of temperature of the plate, and it is on account of the attention necessary that it sometimes happens with beginners that thawing will be unperceived and the knife will push before it the partially thawed material. An accident of this kind can easily be remedied, since it suffices to replace the material in proper position and to allow it to freeze afresh. The cutting of too hard material, however, produces complete failures. If sections fall from the knife upon the plate, they naturally freeze to it, and no attempt should be made to remove them until thawing takes place. The sections can be made of the utmost thinness if such be desired. With some material, however, sections which are too thin cannot well be used; thus, for instance, sections of intestine which are too thin do not stand the transference from the alcohol into the aqueous solution of the dye, as the mere diffusion streams which are produced under such conditions are sufficient to tear them, and this indeed occurs with all loosely-connected material. It follows that in such cases the sections must be cut rather thicker. Some experience is required to regulate the thickness of the section according to the material used. Again, I should like to call attention to the fact that not only the slipping of the knife at the beginning of the procedure, but also unequal thickness of sections, by which they appear striated from being alternately thin and thick, arises from the material having been frozen too hard. The sections are in the latter case apt to break asunder in small streaks. All this may be easily prevented by attention to the rules which have been given above. The bottle which is sometimes placed below the microtome to catch the ether is quite super-

fluous, for if the application of the spray be properly attended to, no ether flows out. Before speaking of the further treatment of the sections, it will be as well to make a few remarks upon the kind of glass dishes to be used. Watch-glasses are to be avoided as unsuitable for the work. Two sizes of solid glass dishes (see Chapter II.), such as are used as salt-cellars, made by hollowing out square blocks of glass, are to be recommended, and also thick-walled round dishes of 5.5 cm. diameter and 11 mm. in depth, not including the thickness of the glass itself. The solid glass dishes are only to be used for stained alcohol, ethereal oils, and anilin oil, the others are for watery staining solutions, alcohols, etc. As regards the latter dishes, before all things it is necessary that the margins be not too high, as otherwise the treatment of the sections with glass needles, forceps, etc., would be difficult. When the sections which have been made in the way before described are looked at more closely, it will be seen that only a small number have spread themselves out in the water, the others being partly so spread out or not at all. The transference of the sections into absolute alcohol is to be done in this way. Next to the dish containing the sections there should be placed two others upon a slate, one of which is filled with water, the other, up to one-third, with absolute alcohol; besides these another solid glass dish is placed near filled with alcohol. First of all the sections which have already spread out are caught up upon a blunt-pointed glass needle drawn out to 4 mm. in thickness and are placed in water; they should be rolled up upon the needle in the water in one direction so as to be unrolled in the alcohol in the opposite direction. With some practice this can be done easily if attention is paid to the following points. The section is allowed to spread itself out in water, it is then rolled up by bringing the needle under the margin and lifting it gently up, and when it is quite without folds, rolling it up by a turn of the needle. All the movements concerned in this operation must be delicately done with the fingers only, not with the arm. In order to facilitate the unrolling in alcohol it is of advantage to carry out the rolling up in such a way that the margins of the sections lie as little as possible over one another, and thus the needle must not be thinner than is mentioned above. Difficulties arise here only with very sticky material. The act of rolling off in the alco-

hol is induced by a gentle moving to and fro of the needle in it, till part of the section is floating and the rest is rolled off by a turning movement (this is only done with the fingers). During the act the needle must not be kept at one place, but must be gently moved in the alcohol from left to right or *vice versâ* according to the position of the floating part; in this way the sections are spread out smoothly. When, now, all the sections which had spread themselves on the water have been transferred to the alcohol, there yet remains the spreading out of those which have remained rolled up. This is done in the simplest possible way; the sections are taken one by one with the glass needle out of the water and dipped for a few moments in alcohol in the dish and then transferred again to water; through the diffusion streams thus set up the sections are carried to and fro on the water and at least one part spreads out perfectly, and they can be thus transferred to alcohol in the way above described. If any sections should still remain which are not spread out they have as a rule a small part which is unrolled, and if this is the case we can easily succeed in getting the needle under this part and then in unrolling so as to dip it again with the unrolled margin uppermost in alcohol, while at the same time one taps the margin of the dish with a needle. The section on its transference into water must lie upon the surface, because the spreading out can only take place there, and the unrolled margin must always be uppermost. Should any sections remain even now which are not properly spread out, one must make use of steel needles and try to unroll them directly; this is generally a thankless and tedious task, and unless the material is very precious it is best to throw these remaining sections away. If a large number of sections has been transferred from the water into the alcohol, and if by these means the alcohol has become diluted, it is advisable to employ new alcohol for the process of dehydration, since the more completely the sections are dehydrated the more thoroughly does the aqueous solution of the dye used for staining penetrate; the lively diffusion streams which are set up causing the watery stain to occupy the position formerly held by the alcohol.

The Staining of the Sections.

Although it is sometimes possible to see under the microscope even single unstained fission fungi lying in the tissues, it is absolutely necessary, for more exact examination, previously to stain them so that they are sharply defined from the surrounding tissues. For this purpose anilin colors are used, and of these there is not one which, when applied properly, cannot stain the bacteria. This, however, is not alone sufficient, for the chief desideratum is to stain them differently from their surroundings, and if anilin colors after the first trials are regarded as unsuitable, it is because one does not understand the proper way to differentiate the bacteria in sections which had been diffusely stained with them. The procedure of staining is under some circumstances very easy, and under other circumstances very difficult. It is a question not only of bringing into view all the micro-organisms, but also the ascertaining with exactness their relations, and this is only possible when by particular methods we are able to make each individual part of the tissue so distinguishable from another that they in some way become also sharply defined from their surroundings. Putting aside the staining methods which were designed from the very first to stain the micro-organisms of a tissue only, leaving the other parts unstained, attention has been till now devoted almost exclusively to what are called good nuclear stains. These stains have, it is true, many advantages where only a good view of the tissue is required; the disadvantage that the micro-organisms are covered by deeply-stained nuclei cannot, however, be denied. For bacteriological purposes it is essential above all things to make the nuclei distinguishable from the other parts of the tissue, and I have tried to accomplish this end by methods which would stain the nuclei brightly, and the protoplasm of the cells somewhat more darkly. Such a method in no way interferes with the power of distinguishing the different tissues, but the covering of any stained micro-organism by dark nuclei is avoided. As a proof of bacteria in the vessels, this is, of course, of no great importance, but it is for the cases in which the organisms lie in the cells or between them in cell-accumulations, as is the case, for example, in tuberculous nodules. In such cases we can easily show by comparative trials that preparations in

which the nuclei are brightly stained, many more micro-organisms can be seen than those in which the nuclei are darkly stained. It is not the place to enter here into the chemical and physical processes which take place during the staining; it is sufficiently evident that it is not a mere mechanical deposit of staining stuffs. This is proved by the marked changes which often appear to occur to the stains whereby new colors are produced, which appear in many parts of the tissue. I will mention only the violet color of the fat-cells (Mastzellen) when the tissues are stained with methylen blue. Indeed, our knowledge of physiological chemistry, as well as of the so highly complicated anilin compounds, is not enough to enable us to set up a sufficiently supported hypothesis which would be of practical use as one to work with, althqugh I do not by any means wish to diminish the scientific value of having such a working hypothesis. I have thus contented myself with paying attention to the clearer and intelligible physical processes, and not without result. Starting from the supposition that the stain deposits itself in the interior of the tissues as such, and that it is fixed in it in different ways in different parts, according to the reaction thereof, I always give the preference to those methods which differentiate in a way most sparing of the tissue. On the supposition that many bacteria, *e.g.*, tubercle bacilli, take the stain with difficulty, one believed that one was able to remedy this defect by a long staining (twenty-four hours and longer), as well as by an increased temperature of the staining fluid, but we must recollect that by such procedures the tissue is so over-stained that the selective staining is very difficult, and the deep staining of the bacilli is quite illusory, even if we overlook the direct disadvantage of damage to the tissue. My opinion is that the difficult stainability of some fission fungi in tissues generally is not proved; indeed the ease with which they take up the color in dry cover-glass preparations militates against such a view. In cases where failure results from staining for a short time, the fault lies in the process of differentiation being improperly applied. Any one may convince himself of the truth of this by staining sections containing different bacteria in weak solutions without applying means of differentiation, or by treating them as though they were dry cover-glass preparations. Such considerations make it appear most advantageous not to

stain too deeply, and to seek some indifferent medium for extracting the color which will spare the tissue as much as possible. Such I have found among the anilin dyes themselves. At first I considered the acid staining matters only of much practical value for this purpose; later on I found among the basic ones some with similar properties.

I found a further weak point in the processes hitherto used, viz., the dehydration of already differentiated sections in alcohol, by which under certain circumstances the decolorizing properties of the fluid must have had a very bad effect. I tried to minimize this undesirable accessory effect of the alcohol by adding to it some of the stain in which the sections had been previously stained, and by these means a part at least of the staining matter removed by the alcohol was replaced. Afterward anilin oil (see Chapter II.) was recommended by Weigert as a means of dehydration. I now use stained or unstained alcohol only for the removal of the water superficially lying as it were upon the sections in order to make them spread out in anilin oil.

The alcoholic solutions of the acid stains showed themselves suitable only as a means of extraction of the color from the tissues in cases of bacteria which retain the color very firmly, while they decolorized the others just as quickly as they did the tissue itself, and were therefore of no use without further processes. In such cases I found solutions of the acid and basic staining matters in clove oil suitable, which latter I finally replaced with much advantage by anilin oil, and latterly I have made use of this material only, either pure or containing staining matters, for means of extraction, dehydration, and double staining. It would not be within the province of this short guide to enter into a description of the very numerous stains which I have used during my researches—I shall rather limit myself to the chief. To discover different variations will not be difficult if attention be paid to the essentials of the methods described. In order to give a more comprehensive view of the subject I will discuss seriatim the most important stains, and leave to another chapter the composition of the various staining fluids, means of extraction, etc. The figures appended refer to the formulæ in Chapter II. As the nuclear stains, methylen blue, fuchsin, hexa-methyl violet are perfectly sufficient for the staining of bacteria in the tis-

sue, I shall limit myself therefore to these only. The special description of the technique is given once for all with methylen blue.

General Remarks about Methylen Blue.

Methlyen blue is indisputably the most prominent among all the stains used for fission fungi; it is the only one with which I have succeeded in staining in the tissues almost all kinds of bacteria which have come under my hands for investigation. We had not yet succeeded, however, by the use of any methylen-blue method we had hitherto tried, in bringing into view leprosy bacilli in the tissues, a negative quality of the dye which might be made use of to distinguish them from tubercle bacilli. Likewise, I have not yet succeeded with any methods I have used to stain with it the glanders bacilli, except in much fewer numbers than in dry preparations. I also failed to stain with it the bacilli of mouse septicæmia.

I have now all but succeeded in overcoming all these defects by having regard to the principles already indicated. We could therefore look upon the methods shortly to be described as of general application, if the staining of leprosy and mouse bacilli did not leave something to be desired, as not all of these micro-organisms in the section are stained, and the staining is frequently not sufficiently intense. The most important stage, however, has been attained, and the possibility of the differentiation of these bacilli with methylen blue has been proved, so that we may confidently expect in the future a further improvement in the methods of using the stain. The use of fuchsin and methyl violet cannot yet, however, be quite obviated, even apart from the point of view of differential diagnosis.

Methods of using Methylen Blue.

The sections which are in alcohol are rolled up one by one with the glass needle, and then transferred into a glass dish with carbol. methylen blue, No. 1, so that they spread out in the staining solution, which is easily accomplished by a rolling-off movement in the opposite direction. Half an hour is considered to be the average time for staining; but leprosy bacilli require at least one to two hours. Overstaining, which

renders the differentiation difficult, does not often take place, even if the sections be in the dye for twelve hours or longer. As a mordant I only use the 5 per cent carbol. water and a 1 per cent solution of ammonium carbonate. The sections are taken out of the dye and rinsed in a little water in a dish, and in order that this may be done so that the sections are uninjured, light should be transmitted from below. A small box, open at the side, in which there is a looking-glass, placed diagonally, which throws the light upward through an opening made in the lid, is useful. The sections, rinsed in water, are then extracted with acidulated water, No. 2, until they are of a pale blue color, and are transferred directly into a basin of pure water, after a rinsing in a weak solution of lithium carbonate, No. 3. This action is most important, and decides to a great extent the final result, for, however easy it may be in the majority of cases to hit upon their exact degree of decolorization, it is as difficult in individual instances to extract neither too much nor too little of the color. It is impossible to lay down an absolute rule as to how long a time is necessary for the sections to remain in the decolorizing fluid; it depends much upon the thickness of the section and upon its structure. If we have to do with glanders tissue, for instance, we must pay attention to the color of the blood-vessels, if we wish to see the bacilli which they contain; but, on the other hand, no regard need be paid to them if we are on the look-out for bacilli in the surrounding tissue. It is impossible to properly differentiate nodules consisting of cells and other tissue at one and the same time; it is necessary to make special preparations for each purpose. If the sections are very thin, or if they have not taken much stain for some other reason, momentary dipping of them in the acidulated water suffices for differentiation, and it is to be recommended that the sections be not allowed to get off the needle, but that they should be moved constantly to and fro, until sufficient of the color has been extracted, for it is only by the complete removal of the excess of stain that the required degree of decolorization can be hit upon. If bacilli are lying in the midst of tissue with strongly stained nuclei—*e.g.*, in glanders nodules—their definite differentiation becomes very difficult, as the nuclei retain their stain in the extracting medium almost as firmly as the bacilli. At any rate, the extraction of the color must also be here car-

ried on, till a transparent pale blue tone has been obtained, because without a sufficient decolorization of the nuclei, bacilli can only be seen quite accidentally in light spots. In such difficult cases it is as well to add to the lithia solution one drop of a concentrated aqueous solution of methylen blue.

If we are able to discover from the first preparations we make what method we have to adopt, we shall have good data in making the other preparations, by means of which especially to know how far the extraction of the stain must be carried. Cocci, for instance, lying in heaps require more time for their preparation than is required for the differentiation of individual cocci lying in the tissue; if an equal extraction from the several parts of the tissue does not take place, two sets of preparations must be made, and so on. After this principal differentiation the sections are next treated in the following way. After remaining for a few minutes in water, they are dipped while still upon the needle into absolute alcohol in a glass dish, in which in sections difficult to stain some methylen blue has been dissolved, and are then transferred to methylen blue anilin oil, No. 4. The dipping into alcohol is done to extract as much water as is necessary for the sections to spread out well in the anilin oil; a few minutes suffice to dehydrate them without injuring the staining of the bacilli by extracting more color, for the more the anilin oil itself is stained the less staining matter it will be able to absorb in a given time. After dehydration the sections are rinsed in pure anilin oil and put for about two minutes, for the purpose of clearing and extraction of the anilin, into some ethereal oil of low density, such as thymin, terebin, etc., from whence they are transferred into xylol (see Chapter II.) to remove the oil. In order to be sure that the removal of the anilin oil is complete, it is as well to use a second basin of xylol, from which the section can be mounted in Canada balsam. The xylol can be used for some time if one filters it from time to time, to remove the bits of tissue which have got into it. If the first basin of xylol becomes very brown, one uses the second one in place of the first, and takes another basin, with new xylol.

As is seen from the foregoing, the transference of the section is done with the glass needle only, avoiding the use of filter-paper and section lifter. In order to mount in Canada

balsam the use of the filter-paper may also be avoided by the following method: One takes hold with the thumb and middle finger of the right hand a pair of somewhat bent forceps (kept in stock by Herman Härtel, Weidenstrasse 33, Breslau), made according to my directions; takes hold with it of the margin of a well-cleaned cover-glass, dips it into xylol, and makes the section float over it by means of a steel needle held in the left hand, and then spreads it out without folds on the middle of the cover-glass held under it. This can easily be done with a little practice. Then the cover-glass is taken with the thumb and index-finger of the left hand out of the forceps, the superfluous xylol is allowed to drain from the margin upon blotting-paper, the operation being helped with the forceps; the cover-glass is finally held with the forceps, this time, however, with the concave margin downward, and turned up, by which the side of the cover-glass upon which the section is comes downward, and is placed upon a drop of Canada balsam previously dropped upon a slide, the size of which depends upon the size and thickness of the section. The thicker and smaller the section the more the Canada balsam which is required to fill up the space between the slide and cover-glass; the thinner and bigger, the less is required. In order to hit upon the middle of the slide without much trouble, it is a good plan to scratch once for all the outline of a slide and cover-glass in the corner of a slate provided with a wooden frame. After the cover-glass has been placed lightly upon the balsam, a slight pressure suffices to make it spread out, but with very delicate tissues it is better to leave this simply to the weight of the cover-glass. The xylol clinging to the cover is blown off with a small india-rubber air-ball, which can be made by the insertion of one end of a small glass tube, the other end of which is drawn to a point, into the india-rubber tube of a common air-ball. This instrument can also be used to clean the surface of the cover-glass after the use of an oil immersion, before the balsam is dried. One sucks up the oil in this case with a piece of blotting-paper placed lightly upon it, and puts a drop of xylol upon it and then blows down upon the mixed fluids, by which operation any displacement of the cover-glass is avoided, and such a thorough cleaning is obtained as can never be had by wiping the cover-glass.

This methylen-blue method has the advantage over the

former ones of relative universality and greater certainty of bringing into view all the bacteria in the tissue. Of this, one can best convince one's self by the results of staining with it the micro-organisms more difficult to stain--*e.g.*, malleus bacilli and the bacilli of chicken cholera. The bacilli of glanders are stained, so that almost as many appear as in dry preparations and bear a partial double staining, with a safranin anilin oil, No. 5. Among the chicken-cholera bacilli stained in this way in the tissue, there occur many which are intensely stained, not only at the ends, but also in the middle This method is also very good for typhoid bacilli and tubercle bacilli, but on the other hand, as before remarked, it still gives insufficient results with the bacilli of leprosy and mouse septicæmia.

Preparations thus made show in many respects sufficiently well the structure of the tissue as well as the bacilli, but some material every now and then leaves much to be desired in this respect. In such cases, the sections stained in carbol. methylen blue are decolorized in a strongly diluted watery solution of so-called chlor-hydrin blue instead of acidulated water simply. This color, as are all those before mentioned, with the exception of the black-brown, and the nuclear-black to be mentioned with the fuchsin staining, is to be obtained from the Badische Anilin-Fabrik in Ludwigshafen. It consists of a solution of basic indulin in an acidly reacting thickish fluid, which possesses in a very marked degree the capability of dissolving anilin colors. The chemical composition of it I do not know.

If from this thickish acid solution of indulin with 10 per cent of alcohol added to it, a diluted watery solution, No. 6, is prepared, this can be used like other basic anilin colors for the staining of bacteria, but it offers no special advantages. If, however, a dilute solution of it in water is made without passing the point of transparency, it can be used to extract the methylen blue, and one may thus obtain a sharp staining of the nuclei of the tissue, and besides this, it appears as though by its use the methylen blue becomes more firmly fixed in the bacilli, for sections of anthrax material stained in this way may remain for thirty hours without the bacilli becoming unstained. Whether it is a substitution of indulin for methylen blue, or a combination of the two, I must leave undecided, especially as my investigations on the subject are as yet incomplete. The

process of differentiation in this case always takes place very slowly, and always requires ten to sixty minutes. The surprising fixation of the stain led me at first to wonder whether it would not be possible by previous or after staining with other colors, to differentiate the bacteria, as iodide (iodine) does with violet colors. As I shall show farther on, I have already found out such a color for fuchsin. (Mouse bacilli stain, as I have found out lately, excellently in the tissue with the above-mentioned if one previously stains the sections with carbol. auramin, which is prepared like carbol. fuchsin.)

As a double stain for these preparations safranin anilin oil is greatly to be preferred to eosin on account of its lesser tendency to decolorize the bacilli. For this purpose the sections after the methylen-blue staining is complete, are taken from the xylol and placed into a glass dish in safranin anilin oil, No. 5, to which so much pure anilin oil has been added that the solution is transparent. According to the material and the freshness of the staining solution, from two to ten minutes suffice for the after-staining. A pink glimmer of the sections, which have first been rinsed in pure anilin oil, serves as a control experiment. The anilin oil is finally extracted by means of an ethereal oil and xylol. Although at the first glance the above-described method appears somewhat detailed and minute, every one who has made himself well acquainted with the technique will soon alter his opinion upon the point. The transference of the sections without blotting-paper and section lifter saves much time, and this is of especial importance when a considerable number of sections are to be made.

In my work upon "Methods of Staining" ("Zeitschrift für Hygiene," von Flügge und Koch, 1 Band, 1886) I recommended the treatment of the sections in a watery solution of oxalic acid before staining with alkaline methylen blue. This has now been made superfluous by the use of the solution of carbol. methylen blue, but it still holds good for staining sections in alkaline methylen blue, dehydrating in alcohol containing anilin oil, methylen blue, and decolorizing in fluorescin oil of cloves, No. 18, or eosin oil of cloves for a number of fission fungi, the differentiation of which in the tissues offers fewer difficulties; it is, however, certainly unfit for typhoid and malleus bacilli. The methylen-blue process of Unna ("Dermatological Studies") comes nearest to mine, but for the staining

of malleus bacilli it is inferior, and I now prefer to use the carbol. methylen blue method. In order to make the position of the bacteria in the tissues very distinct I can recommend the following method:

Multiple Staining with Carmine, Methylen Blue, and Nigrosin.

The sections previously stained with carmine, and then with carbol. methylen blue are differentiated with a watery solution of nigrosin (Badische Anilin-Fabrik) with addition of 10 per cent chlorhydrin, otherwise they are treated as though with simple methylen blue staining. The nuclei appear red, the fission fungi blue, the protoplasm and the capillaries, which become very prominent, gray.

The Making of Dry Preparations.

I now insert a description of a method for making dry preparations. I have only had to use it latterly with the methylen blue staining of malleus bacilli in the tissues, but I wish not to postpone the description of the technique.

With malleus bacilli lying in well-stained nodules of tissue this method without doubt gives excellent results as regards the number of the bacilli stained and the quality of the staining; it is recommended in addition to the above, and shows the structure of the tissue still better. Its excellence rests upon the fact that besides the exclusion of alcohol for dehydration of the already differentiated section, by which any further decolorization of the bacilli is avoided, there takes place here by the drying on of the section to the cover-glass a glassy brightening up of the tissue with the nuclei which obviates the covering up of the bacilli in the microscopic picture. The section also becomes thinner, and, through this, better for showing up more of the tissue at one time.

The sections stained in carbol. methylen blue are extracted in acidulated water till their color is light blue, washed out for a few moments in water which has been rendered slightly alkaline with carbonate of lithium, and transferred into clean water till they are perfectly free from the previously applied fluids. If a large number of sections has been stained at one time, it is best to do the transference of each section upon a

cover-glass in another dish of water. For this purpose one takes hold with the thumb and middle finger of the right hand of the forceps above described, which is bent toward its flat surface, seizes with it the edge of a perfectly clean cover-glass and places it under the section floating in water, the left hand at the same time with a needle attending to the proper spreading out of the section. One tries now by a careful lifting up of the cover-glass to retain the section without folds upon its upper surface, which is certainly a difficult operation if the cover-glass is not quite clean; because in that case small drops of water which prevent a complete adjustment of the section are found between it and the cover-glass, and cause it to slip sideways. When the section is properly fixed to the cover-glass and removed from the water, the cover-glass is taken with the thumb and forefinger of the left hand, the superfluous water is allowed to run off the edge upon blotting-paper, the upper surface is wiped with a cloth, and the cover-glass is then placed upon blotting-paper. If any drops of water adhere to the section, they may be removed with a bit of blotting-paper, but any touching of the section is to be carefully avoided. For the beginner it is best to press down the edges of the cover-glass with a small piece of lead during the following operation, to prevent its flying off. One directs upon the section a vertical stream of air from the before-mentioned air-ball syringe, first upon the middle, then toward the sides of the section till it is firmly fixed on the glass; with this yet a few drops of water are pressed out and lie to the side of the section. It is best not to pay any attention to these for the present, since when an attempt is made to blow them down, the stream of air very easily gets under the margin of the section, and this means doing the whole process over again. The stream of air is directed upon the section to and fro until it does not cause any darker shading when directed upon it, which means until the section is nearly free from water. When the drops of water which might be still adhering to the section have been removed by blotting-paper, the cover-glass with the section uppermost is placed upon a polished glass plate which is slightly warmed over a spirit-lamp. If we watch the sections we are able to recognize a time when they have become transparent and glassy, which does not, however, indicate that they are completely dry. This takes place if the sections

remain about five minutes longer upon the glass plate. The temperature of the plate must not be above 30° R., because otherwise the sections become spotted and unclean. From the glass plate we place the cover-glass into ethereal oil and afterward transfer them to xylol and balsam.

The Making of Dry Cover-glass Preparations from Liquids.

As is well known, dry cover-glass preparations were first made for the purpose of proving the presence of bacteria in such animal fluids as blood and sputum. This process is of great practical value, and in its execution is so simple that in a very short time there will be no practitioner who will not be able to make such preparations for himself.

The covering of the cover-glass with the fluid to be examined is done so that a little of the fluid is placed upon the glass and is spread out equally with a platinum needle which has been previously heated to redness. This is sometimes—as, for example with blood, urine, etc.—very easy; it becomes, however, more difficult when the fluid is tough viscid mucous sputum, which resists the equal spreading-out upon the cover-glass. In order to overcome the difficulty, the following plan is to be recommended: First of all, a piece of mucus is rubbed to and fro over the cover-glass with the platinum needle, until some deposit has taken place. Then one directs upon the little lump a vertical stream of air out of the air-ball syringe, by which means a part always spreads out and dries on at once. Before the whole mass is dried, one spreads it out again with the platinum needle, removes with it the superfluous material by pushing it over the margin of the cover-glass upon blotting-paper, and blows the rest perfectly dry. In this way we easily succeed, with a little practice, in spreading out the toughest material in a proper thickness. A too thin layer is as bad as one too thick. The dry preparations thus made are now drawn two or three times through the flame, with the material uppermost, till the material is quite coagulated, without being burnt. In consequence of the previous blowing of the material, a moderate heating in the flame suffices. The cover-glasses thus prepared are now stained, and then subjected to the means of extraction suitable in each case.

If, for instance, one wishes to examine blood containing anthrax bacilli, the cover-glass is stained for five minutes in carbol. methylen blue, rinsed in water, differentiated in acidulated water. With a very thin layer a few seconds suffice; with a thicker one, longer. The cover-glass is taken, with the forceps, out of acidulated water, always with the covered surface uppermost, rinsed for a few moments in a weak solution of carbonate of lithium, and then in water, or a jet of water is directed upon it for about a quarter of a minute. Next, one takes the cover-glass between the thumb and forefinger of the left hand, dries the lower surface well, places upon blotting-paper, and blows the upper surface dry with the air-ball syringe. It is only necessary now slightly to warm the cover-glass over a flame in order to be able to clear with xylol and mount in Canada balsam. In this way all bacteria which can be stained in methylen blue are stained. For the staining of tubercle bacilli in sputum, etc., the same process must be employed, only that we leave for three minutes in carbol. fuchsin, extract in a 30 per cent nitric acid, NHO_3, transfer into 60 per cent alcohol, till only a faint glimmer remains, wash out the acid with a great deal of water, dry the lower surface of the cover-glass and, placing it upon a large plate of glass, add a drop of a concentrated aqueous solution of methylen blue. In five minutes the material is so stained blue that the glaring red tubercle bacilli appear upon a blue background, while no other fission fungi have retained the fuchsin color (Koch-Ehrlich). With these two methods all known fission fungi can be stained in dry cover-glass preparation.

Fuchsin Methods.

Although methylen blue very probably stains all fission fungi without any exception, and allows more or less well their differentiation in the tissues, yet the latter does not take place in some cases by any hitherto known method of employment with that certainty which is so necessary in such like investigations. We have, however, as a stain best calculated to fill up the gap, fuchsin, since it stains very certainly, sharply, and permanently the bacilli of tubercle, leprosy, and mouse septicæmia, but as regard the other fungi—*e.g.*, typhoid and malleus bacilli—it either altogether fails or is by far inferior to

methylen blue. We cannot yet do without the principle of the Koch-Ehrlich method of staining tubercle bacilli for the purposes of differential diagnosis, but where this is not so important, an abundant staining of bacilli is necessary, and a good differentiation of the tissue is especially desired, my methods offer some advantages.

Modification of the Koch-Ehrlich Method of Staining Tubercle Bacilli in the Tissue.

Staining of the sections in carbol. fuchsin, No. 7, ten minutes; decolorization in 30 per cent HNO_3, and then in 60 per cent alcohol, until they are only pink in color; washing out of the acid in much water, three minutes' dehydration in absolute alcohol, transference into methyl-green anilin oil, No. 8, five to ten minutes, diluted with half its bulk of pure anilin oil, then into ethereal oil two minutes, and then into two capsules of xylol. The staining of the tissue by the methyl-green takes place only after the transference into ethereal oil and xylol, and should it appear too weak the section must be again placed in the methyl-green solution until the desired tone has been obtained. The tissue appears after this well differentiated, and the bacilli are stained sharply. If one prefers the second stain to be methylen blue, one takes the sections out of the alcohol and places them in a weak alkaline solution of methylen blue for five to ten minutes, dehydrates in alcohol, and transfers into ethereal oil and xylol.

Simple Method of Staining Tubercle Bacilli in the Tissues with Fuchsin.

Of all the mordants made use of with fuchsin in staining, 5 per cent carbol. water appears to me to furnish, for sections, the best and quickest results. Carbol. fuchsin, No. 7, stains in ten minutes both tubercle and leprosy bacilli in the tissues, and remains so fixed that they can be brought into view with certainty not only with the later-on given means of differentiation, but they are also not discolorized by a 30 per cent HNO_3 solution. If one places the sections after thorough rinsing in water in fluorescin-alcohol, No. 9, for a few minutes, and then transfers to ethereal oil, xylol, and balsam, several results are obtained according as the color is more or less ex-

tracted. In the latter case the nuclei remain somewhat stained, in the former, analogous to Gram's staining, the red bacilli appear upon an unstained background, to which, by the placing of the section for five minutes in methyl-green anilin oil, one can easily give a stain more agreeable to the eye. This method is, on account of its great simplicity and certainty, especially fit for cases where there is a question of proving the presence of bacilli of this group, and where the making of a large number of sections is necessary. In order to clear up finer histological changes and to demonstrate the exact position of the bacilli, several other methods are to be advised, of which, however, I will mention only a few.

Triple Staining of Sections containing Tubercle Bacilli.

The sections are first of all delicately colored in Delafield's hæmatoxylin solution, No. 10, freed for some hours from alum in a great deal of water, dehydrated in alcohol, and stained for ten minutes in carbol. fuchsin. After rinsing in water the extraction of the fuchsin from the tissue is done in fluorescin-alcohol, then in pure alcohol, ethereal oil, and xylol, and finally in auramin anilin oil, No. 11, for a few minutes, until a yellowish tone has been obtained, finally rinsing in pure anilin oil, ethereal oil, xylol, and balsam. The nuclei appear violet, the protoplasm yellow, and the bacilli red. This method shows the cell-boundaries very sharply defined, and gives generally excellent tissue pictures. The dark nuclear staining, however, does not admit of the greatest possible number of bacilli being brought into view, because some may be covered up by the dark nuclei. This method is therefore especially to be used for the staining of material in which the bacilli are in considerable number. The covering up of the bacilli by nuclei is avoided by the next method.

Staining of the Tubercle Bacilli in the Tissue with Nuclear-Black, Carbol. Fuchsin, and Methyl-Green.

Nuclear-black obtained from Dr. Grübler, in Leipzig (Bayersche-Strasse, 12), is diluted with three to four parts water, and the dehydrated sections are stained with it for a couple

of minutes till they have taken a dark gray tone. The manipulations then to be undertaken are the following: Rinsing in weak watery solution of carbonate of lithium, No. 3, which extracts at the same time a part of the color, and this is done until the sections have taken a light gray tone. Then rinsing in pure water, dehydrating in alcohol for five minutes, staining in carbol. fuchsin ten minutes; rinsing in water, decolorizing in fluorescin-alcohol, washing in pure alcohol, and then transferring into methyl-green anilin oil, five to ten minutes, No. 8. It is good not to use the latter in too concentrated a form; two drops of a strong solution mixed with pure anilin oil in a glass capsule suffice. The staining with methyl-green takes place here also only after the transference into ethereal oil and xylol. The advantages of this method consist in an exceedingly delicate differentiation of the tissue which allows all the individual parts of the tissues to be well recognized without the bacilli being covered by the over-staining of the nuclei. The latter appear red, while nuclei vessels and protoplasm appear to stand out in several shades of blue-green. By means of the application of other colors dissolved in anilin oil other variations of stain may be obtained.

Staining of Bacteria not belonging to the Group of Tubercle Bacilli in the Tissue with Fuchsin.

Many bacteria (fission fungi) may be very beautifully stained in the tissues by the following method—*e.g.*, Koch's mouse septicæmia, anthrax, and other bacilli which behave analogously with the colors used and several kinds of cocci; typhoid and glanders bacilli, however, give negative results.

The sections dehydrated in alcohol, are first of all stained for from three to five minutes in carbol. fuchsin, rinsed in water, dipped for one moment into alcohol, and then extracted in methyl-green anilin oil. This latter solution, which in the before-mentioned method was only used for double staining, here serves at the same time for the extraction of the fuchsin, for which purpose, according to the thickness of the section and the intensity of the stain, a longer or shorter time is required. Very thin sections are differentiated in fifteen minutes, while thicker ones require sometimes two hours. The exact point of sufficient decolorization is not, however, difficult to recognize, if one puts the sections into ethereal oil and xylol and then

alcohol and afterward stain for five minutes in carbol. fuchsin, we are able to decolorize them with fluorescin alcohol without the bacilli becoming decolorized. This staining certainly does not resist for long the action of strong acids, but if this influence has not been allowed to act for too long a time, a pale fuchsin stain is retained by the bacilli. Many analogous bacilli behave similarly with respect to these methods; some, however, do not. We publish the results before the completion of our investigations upon the subject, because it is a question essentially of a new principle, the greater or less importance of which should be settled from as many standpoints as possible. It is probable that many other colors behave in the same way as those about which we have been speaking.

Double Staining with Carmine, Fuchsin, and Acid Violet.

After previous staining in carmine, No. 14, the sections are double stained for a few minutes in carbol. fuchsin, slightly dehydrated in alcohol and finally decolorized in acid violet anilin oil, No. 12, for which process half to two hours are sufficient according to the size of the section. The nuclei are carmine red, the protoplasm violet, bacilli fuchsin red. This method is especially appropriate for fission fungi within the vessels. It produces too, as I may remark, very fine results as a double stain—*e.g.*, in carcinomatous tissue.

Violet Methods.

Hexamethyl violet as well as Victoria blue, contrary to methylen blue and fuchsin, has the peculiarity that it allows itself to be so fixed in certain fission fungi by means of iodine, that a perfect decolorization of the surrounding tissue may take place with strong decolorizing agents, without any interference with the staining of the bacteria themselves. Putting aside the different composition of the hexamethyl violet solution, No. 15, and Victoria blue solution, No. 16, the further treatment of the sections stained with them is the same, so that the description of my modification of Gram's method is also applicable to the after-treatment of these stained sections in Victoria blue. Sections stained with violet can also be differentiated with dilute acid and alcohol. But this offers

no particular advantages, and is better replaced by the above-described method.

Modification of Gram's Method.

The results obtained by the employment of the original method of Gram not infrequently leave something to be desired. First of all, the deposits of staining matter which often occur upon the sections when anilin water solution has been used are very tiresome, as they cannot be removed even by a very energetic extraction in alcohol and clove oil. Then, again, it is difficult to determine the exact time for washing the sections in alcohol before they are to be transferred into the iodine solution; if too short a time is allowed, deposits are apt to occur, while rinsing for too long a period injures the staining of the fission fungi. Then, again, the process of decolorization in alcohol lasts often for a very long time, and requires frequent changes of the spirit. All of these drawbacks are certainly avoided in the following way: Stain the sections in a violet solution, No. 16, diluted one-sixth with 1 per cent watery solution of ammonium carbonate, or in Victoria blue solution, No. 16, for five minutes (the latter solution is not to be diluted). Then rinse thoroughly in water and transfer to Gram's solution, No. 17 (two to three minutes), again rinse in water, and extract the stain in fluorescin alcohol, wash in pure alcohol and oil of cloves—or what I now prefer, anilin oil—and finally extract with a thin fluid ethereal oil and xylol. Mount in Canada balsam.

The fission fungi which are stained by this method appear sharply stained in the tissue, which is free from deposit and quite decolorized. The durability of the preparation leaves likewise nothing to be desired if the ethereal oil has been thoroughly removed from the sections by xylol-dammar balsam, or when Canada balsam free from oil is used for mounting. If one chooses to double stain, especially with carmine, there takes place, in spite of our precautions after a time, weeks or months, some fading of the color of the bacilli, certainly in consequence of chemical influence of the other stains used. In spite of this, I very much recommend the following double stain with carmine, because of the very beautiful results it gives.

Double Staining with Carmine and Violet.

The sections are first of all stained in carmine solution (Caccati), No. 13, or, as I have lately preferred, in any alkaline carmine solution (No. 14, *b*), rinsed thoroughly in water, and then exposed for several hours to the influence of acid carmine (No. 14, *c*). After this again were rinsed in water, dehydrated in alcohol, and then submitted to the above-described modification of Gram's method. This method is certainly the best of the double staining processes with violet which I have used.

Another Modification of Gram's Method.

The dehydrated unstained specimens or those previously stained with carmine are placed for ten minutes in concentrated watery violet solution to which HCl (one drop in fifty) has been added. They are then well rinsed in water, treated as usual with Gram's solution, again rinsed in water, dipped for a few seconds into absolute alcohol in order to remove the adhering water, and finally put into pure anilin oil, which will provide for the extraction and differentiation, and at the same time will absorb the last trace of water. After the decolorization has been accomplished, transference into ethereal oil, xylol, and balsam follows.

If we desire to stain tubercle bacilli with violet, the first modification of Gram's method should be selected, but the sections must be left for one to two hours in the stain. While Gram's stain has in general a great value because of its importance in differential diagnosis, I may add that the staining with violet without iodine and after differentiation with weak acids or alcohol does not offer any advantages and is superfluous.

In conclusion, I should like to recommend the following course of work to beginners. First of all, the technique of making sections is to be practised most thoroughly, then one must begin with the staining of anthrax bacilli in tissues, first of all by the methylen blue method. At the same time the making of dry preparations and the technique must be thoroughly practised.

This should be followed by the staining of the same bacilli with fuchsin and violet. The next task will then be the

staining of tubercle bacilli in dry cover-glass preparations and in the tissues with fuchsin, then with violet, and last with methylen blue. After this the staining of the most difficult fission fungi is to be undertaken—*e.g.*, from chicken cholera, from typhoid, glanders, etc. This must then be followed by the staining of several other cocci and bacilli and researches about their behavior with Gram's and other methods, as well as comparisons with methods which have not been here described, and finally independent investigations in order to arrive at new and better methods, while making use of the above-indicated principles and the above-mentioned and other colors.

Finally, a few more words about the durability of the preparations:

The most permanent are the methylen-blue preparations and those stained with fuchsin, which resist the stronger means of extraction. Preparations stained simply by Gram's method are also very lasting. With their double staining, however, there takes place more or less quickly a fading of part of the bacteria, while another, mostly smaller, part of the same remains, sometimes for years, unchanged. Fuchsin preparation extracted with anilin oil likewise appear to be very sensitive to double staining, so that a very careful washing of the pre-stained sections in much water is here to be recommended even more than in other cases.

CHAPTER II.

FORMULÆ, APPARATUS, AND METHODS.

Composition of the Staining Fluids.

No. 1. *Carbol. Methylen Blue.*—Ten cc. of absolute alcohol are poured over 1.5 gm. of methylen blue in a mortar and 100 cc. of a 50 per cent aqueous solution of carbolic acid are then added, and the whole is gently rubbed together until the pigment is dissolved. If a small quantity only is wanted half the quantities may be taken, since after a time the staining properties of the solution may decrease.

It may be stated once for all that all aqueous solutions of dyes should be filtered before use.

No. 2. *Weak Acidulated Water.*—Ten drops of hydrochloric acid to 500 cc. water. The water used may be distilled, or ordinary tap water if pure, or boiled water.

No. 3. *Lithia Water.*—To 1 cc. water add 6 to 8 drops of a concentrated aqueous solution of lithium carbonate. More concentrated solutions may serve to remove some of the stain from sections over-stained with nuclear black.

No. 4. *Anilin Oil Solution of Methylen Blue.*—A quantity of methylen blue such as will go upon the point of a knife is rubbed up in a mortar with 10 cc. of anilin oil. Although the whole of the dye may not be dissolved, the whole is poured unfiltered into a little bottle in which, after a time, by the deposit of the undissolved pigment the oil becomes clear. A few drops of this solution diluted with pure anilin oil to the required strength may be employed for staining in one of the solid glass dishes before described.

No. 5. *Anilin Oil Solution of Safranin*—Is made in the same way as No. 4, with safranin instead of methylen blue.

No. 6. *Solution of Chlorhydrin Blue.*—Ten gm. of the Badische Anilinfabrik chlorhydrin blue is dissolved in an equal quantity of absolute alcohol, and 90 cc. of water are added.

No. 7. Carbol. Fuchsin.—One gm. fuchsin, 10 cc. alcohol, and 100 of a 5 per cent aqueous solution of carbolic acid.

No. 8. Anilin Oil Solution of Methyl Green.—As in No. 4, with methyl green instead of methylen blue.

No. 9. Alcoholic Solution of Fluorescin.—One gm. of yellow fluorescin solution is rubbed with 50 cc. absolute alcohol, and the whole is poured into a bottle in which, after a time, the undissolved part settles at the bottom. When about half is used, the bottle may be filled up with alcohol, and this procedure may be repeated as long as any of the precipitate remains undissolved. The selective power of red fluorescin is less marked.

No. 10. Delafield's Solution of Hæmatoxylin.—To 200 cc. of a concentrated saline solution of ammonia alum, 2 gm. of hæmatoxylin dissolved in 12.5 cc. absolute alcohol are added. Afterward the solution should be exposed to the air and light for three to four days, should then be filtered and mixed with 50.5 cc. of glycerin and 50.5 cc. of methylated spirit. The solution should be allowed to stand until it is of a dark color, and should then be filtered and preserved in a well-stoppered bottle. Before using the solution, dilute with water, and remember that the weak solutions give the best results. This logwood solution is to be preferred to all others of the same dye, as by its use deposits upon the sections do not occur.

No. 11. Anilin Oil Solution of Auramin.—Auramin is very easily dissolved in anilin oil, so that a very few drops of a concentrated solution of it mixed in a suitable glass vessel mixed with 4 to 5 its bulk of pure anilin oil suffices for the purposes of differentiation and double staining.

No. 12. Anilin Oil Solution of Acid Violet.—As in No. 4, with acid violet in the place of methylen blue.

No. 13. Carbol. Black-brown.—As in No. 7, but with black-brown of the Frankfurt Anilin Company.

No. 14. Carmine Solutions.—a. Caccati's.—Twenty gm. of crystallized carbonate of sodium are dissolved in 100 cc. warm water, to it 5 gm. of carmine are added, and the solution is boiled. Afterward 30 cc. absolute alcohol are added. Next day the solution is filtered and 300 cc. of water with 8 cc. of a 20 per cent water and solution of acetic acid and 2 gm. of chloral hydrate are slowly added. A quarter of an hour is required for staining with this solution.

b. Lithium Carmine (Orth).—2.5 gm. of carmine are dissolved in a cold saturated solution of carbonate of lithium. The solution stains in a few minutes.

c. Hydrochloric Acid Solution of Carmine.—To 50 cc. alcohol (of 60° to 80°) add 4 drops of HCl and 0.5 gm. carmine, boil for 10 minutes, and filter, cold.

No. 15. *Solution of Hexamethyl Violet.*—One gm. of crystallized methyl violet is dissolved in 90 cc. water and 100 cc. alcohol.

No. 16. *Solution of Victoria Blue.*—One gm. is dissolved in 50 cc. alcohol of 50°.

No. 17. *Solution of Iodine in Iodide of Potassium.*—Two gm. I, 4 gm. KI, dissolved in 100 cc. water. Of this a little is taken, when wanted, and mixed with water until the solution is of the color of Madeira.

No. 18. *Oil of Cloves Solution of Fluorescin.*—A knife-point of yellow fluorescin solution is rubbed up with 15 cc. oil of cloves, put in a bottle and allowed to settle; the supernatant fluid becomes clear.

Microtomes.

Dr. H. Kühne has thought it necessary to mention only one form of microtome, viz., that of Katsch, of Munich. It appears to me, however, that it would be as well to give a short account of several other forms which are used at the present time, especially as Katsch's microtome is little known in England. For general remarks on microtomes, however, and the principles upon which they are constructed, the reader may be referred to "The Manual for the Physiological Laboratory," 4th ed., pp. 23–27.

The microtomes mostly used in England are those made by Messrs. Swift and Son (Tottenham Court Road), and known by the name of Williams' microtomes (Figs. 1 and 2).

In the first form of this microtome (Fig. 1) the freezing agent is a mixture of ice and salt. This microtome is of great value when it is easy to procure ice. In the second form (Fig. 2) the ether spray apparatus is employed to procure the requisite freezing temperature.

In both forms the material to be cut, after having been soaked in water for twelve hours, is immersed in strong mu-

celage for one hour, and then is frozen with the adhering gum

FIG. 1.—Williams' Ice and Salt Freezing Microtome.

FIG. 2.—Williams' Ether Freezing Microtome.

by being placed upon the top of the brass cylinder in the centre of the circular glass top of the microtome, the ice and salt

mixture or the ether spray apparatus being used to supply the necessary cold. The sections are cut by means of a razor held firmly in a triangular frame supported by three screws. By lowering the anterior screw little by little, the knife is gradually lowered, and sections are cut by a to-and-fro movement, either directly or slightly obliquely forward, of the knife-bearing triangle. The same microtome may be used for cutting sections imbedded in paraffin or wax. The cost is £2 14*s.* for the ice and salt microtome, and £3 3*s.* for the ether spray microtome. The cut sections are first of all washed free of adhering gum with water at 40° C., and are then ready for staining.

In Fig. 3 is seen an engraving of Katsch's ether freezing

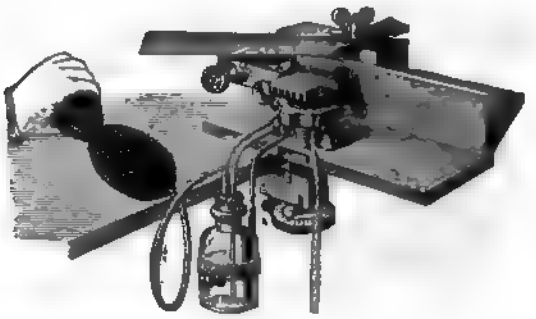

Fig. 3.—The Ether Freezing Microtome of Katsch (Munich).

microtome. The method of using it is well explained in the text. The cost of the microtome is £4 17*s.* It is a very handy instrument, and is a good deal used on the Continent.

A somewhat similar instrument is made by Schanze of Leipzig, also of considerable practical value; it offers some advantages over Katsch's instrument. It is made in four sizes, the cost of which complete is respectively £8 15*s.*, £6, £5, and £4 5*s.*, according to the length of the plane along which the metal wedge bearing the razor can travel, viz., 40 cm., 25 cm., 20 cm., and 17 cm. A microtome made by Zeiss of Jena, after Körting, is very similar. Its cost complete is £7 12*s.* 6*d.*

A very excellent microtome, and one which can be well recommended, is that of Reichert of Vienna (Messrs. F. E. Becker, Hatton Wall, and Messrs. C. Baker, High Holborn,

supply Reichert's apparatus—Fig. 4). The principle of action is much the same as of those microtomes before described. The razor is carried by a heavy metal wedge which works with little friction in an angular slot. There is an automatic action for raising the imbedded material. The cost of this microtome complete for cutting both frozen and imbedded material is about £7.

The microtomes of Jung, of Heidelberg, are of great delicacy. The prices of the three sizes made complete are respect-

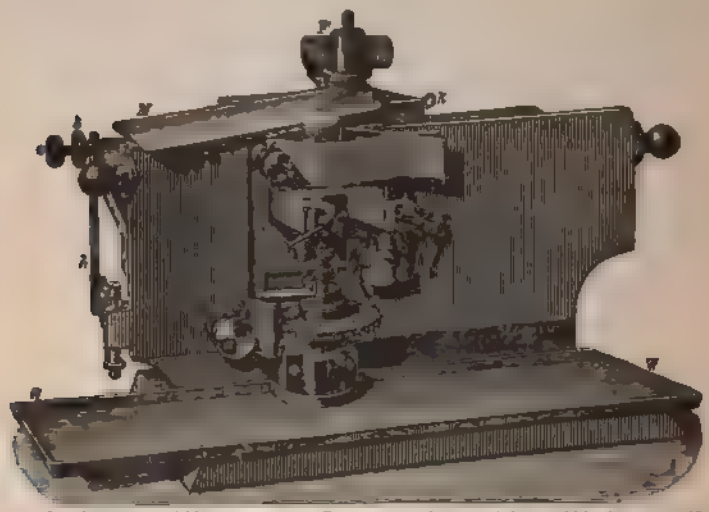

FIG. 4.—Reichert's small Microtome. M Razor carried on a solid metal block K F Clamping arrangement for the razor, by knocking against the screw c fixed by milled head b, the razor carrier by means of a spring arrangement (a) not seen in figure, turns round the wheel z, and so raises the object to be cut held in the object carrier g, which is fixed at f by a small vice. It can also, when necessary, be inserted into d; and i is the indicator of the amount of the raising of the object which takes place each time the spring arrangement c h is set in action

ively about £15, £12, and £8 10s. Several microtomes on this (Rivet's) principle are made, of which Reichert's is very excellent (the length of the plane of the razor is 30 cm.). The cost complete is about £9.

Boecker, of Wetzlar, makes an excellent microtome, which is, in my opinion, not surpassed, for £9 9s.

Leitz, of Wetzlar, manufactures a so-called support microtome, which costs complete £7.

Meyer, of Enge, Zurich, also supplies a microtome, made

on much the same principle as Reichert's, in three sizes complete, £9 10*s*., £8, and £6 respectively.

There are many more microtomes which might well be mentioned if space permitted.

Imbedding.

The use of the freezing microtome is chiefly to be recommended on account of the saving of trouble it permits. It is not always the best way of cutting sections, and when the tissue is very delicate and brittle must not be employed. In such cases the material to be cut may be imbedded either in celloidin (or, what is much the same, in collodion) or in paraffin.

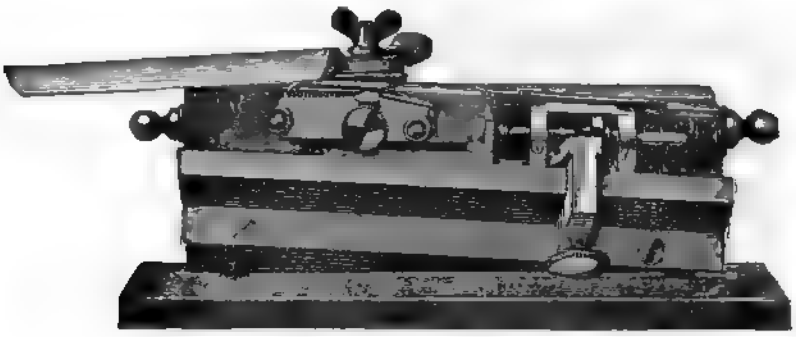

Fig. 5.

The former imbedding material is to be preferred, as sections may be easily stained after they have been cut in celloidin, whereas if paraffin has been employed the after-staining process is very tedious. Both methods of imbedding will, however, be given.

I. *The Celloidin Method.*—The pieces of material to be cut, which should not as a rule be larger than dice, and previously properly hardened, should be placed in a well-stoppered bottle of absolute alcohol for twenty-four hours and should then be transferred to a second bottle, containing a mixture of equal parts of absolute alcohol and methylated ether for twenty-four hours. The pieces of material are then ready for placing in the celloidin solutions, first of all into a thin solution of about the consistence of thin syrup, for twenty-four

hours, and next in a thicker solution of about the consistence of white of egg, for twenty-four hours. These solutions are made by dissolving as much celloidin (which is sold in chips in cardboard boxes at about 4*s.* the ounce) as is necessary for each in equal parts of absolute alcohol and ether. After the celloidin has thoroughly penetrated, the pieces should be taken out and mounted one by one on stout corks, allowed to remain exposed to the air for about ten minutes, and should then be placed for twenty-four hours in methylated spirit and water, equal parts. All of the steps may be hurried somewhat, and twelve hours in each solution is no doubt sufficient, but the success of the operation is more certain if the time allowed is longer. Instead of celloidin, many workers employ collodion. It is well to have four bottles, labelled Nos. 1, 2, 3, and 4, containing the required solutions, so that the material can be transferred from one to the other without loss of time.

II. *The Paraffin Process* is as follows: The pieces of material are, as in the celloidin process, first placed for twenty-four hours in absolute alcohol; next in anilin oil for twenty-four hours; next in xylol for twenty-four hours; next in paraffin dissolved in xylol for twenty-four hours; and finally in paraffin at a temperature of 40°–50° C. for from twelve to twenty-four hours. After this the pieces are taken out of the hot paraffin, and mounted on small solid blocks of wood for cutting with one of the microtomes above described, or may be placed on a piece of sheet glass to cut with the triangle-mounted razor of Williams' microtome.

Hardening Reagents.

For tissues suspected to contain micro-organisms opinions are divided as to the best hardening reagent. Absolute alcohol, methylated spirit, and Müller's fluid each has its advantage, and no fixed rule can be laid down. I prefer myself to use spirit, as a rule, for this purpose, but Müller's fluid is good when there is no press for time, and absolute alcohol when very rapid hardening is required. I seldom use the chromic acid and spirit mixture, which is so excellent for ordinary histological work.

Solid Glass Capsules.

These little glass dishes, formed by hollowing out a solid block of glass, are much recommended in the place of watch-

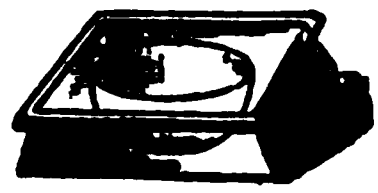

Fig. 6.—A solid Glass Capsule.

glasses. They are less likely to be overturned, and can be conveniently covered (as in Fig. 6) with a glass plate.

Anilin Oil.

This fluid is made use of freely to differentiate stained micro-organisms, as in the modification of Gram's method, and also to dehydrate instead of alcohol. The dark brown anilin oil answers the purpose as well as the pure (and very expensive) light yellow oil.

Xylol.

Xylol is used to extract the clearing oil, such as oil of cloves, from sections before mounting, lest the anilin color be dissolved away by the traces of the ethereal oil which adhere to the sections. It does not satisfactorily clear the sections itself. Canada balsam is now generally used in a solution with xylol or benzin. Instead of oil of cloves, oil of bergamot may be used, or oil of cedar, but neither is so good a clearing reagent.

Of Preparing Bacteriological Sections.

The whole of the manipulations necessary for preparing the sections after a first staining can, as a rule, be done on the slide. The practice of differentiating, washing, double-staining, dehydrating, and clearing the sections on slides will be found of value, since all the processes used can in this way be better controlled.

Microscopes.

It is practically useless to attempt the investigation of bacteriological specimens without a microscope having a sub-

stage condenser on the pattern of Prof. Abbé's, and an oil immersion lens of one-eighth to one-sixteenth inch focus. A microscope somewhat after the pattern of Fig. 7 is recom-

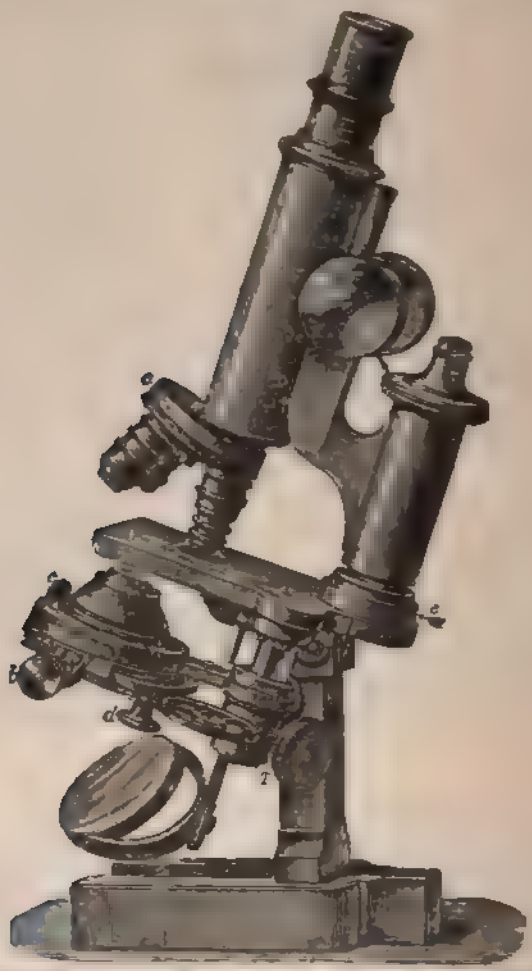

FIG. 7.—Reichert's Model Microscope, No. II. *b* a Nose piece to carry three glasses. *b c d*. Abbé's substage condenser and arrangement. *e* Fine adjustment-fixture. *T* Arrangement for fixing Abbé's apparatus.

mended. Such an instrument, differing as to details, is made by Zeiss, of Jena; Reichert, of Vienna; Leitz, of Wetzlar, and by a good many other Continental makers whose names it is

not necessary to specify. Several English firms, too, are now making suitable microscopic stands for bacteriological work—*e.g.*, Messrs. H. Crouch, Barbican, and Messrs. Swift and Son, Tottenham Court Road. The immersion lenses of Zeiss, Reichert, and Leitz are excellent. Those of Zeiss are the most renowned.

ON THE PRESENT POSITION

OF

ANTISEPTIC SURGERY.

BY

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ON THE PRESENT POSITION OF ANTISEPTIC SURGERY.

At the International Congress in London in 1881, Robert Koch demonstrated in King's College his then new method of cultivating microbes upon solid media. The illustrious veteran Pasteur was present at the demonstration; and at its conclusion exclaimed, "C'est un grand progrès, monsieur." How vast have been the extensions of our knowledge which have resulted from that great step in advance! Of these none perhaps have been more striking than Koch's own brilliant discovery of the cholera microbe, picked out with unerring precision by his beautiful method from among the multitude of bacteric forms that people the intestinal contents, and grown and studied with as much definiteness as if it were a cabbage or a rose.

But while we have during the last nine years learned so much more of the nature and habits of the micro-organisms which invade our bodies, a new and surprising light has been thrown within the same period upon the means by which the living animal defends itself against their assaults. This we owe to the eminent naturalist Metchnikoff, who, having long carefully studied intracellular digestion in the amœboid cells which form the main mass of the bodies of sponges and other humble organisms, was prepared to observe and rate at its true value an analogous process in the wandering leucocytes of vertebrata. He found that these migratory cells, with whose amœboid movements we have been long familiar, feed also like amœbæ, and while almost omnivorous in their appetites, have a special fondness for bacteria; taking them into their protoplasmic substance and digesting them, thus preventing their indefinite propagation among the tissues. The

cells which exercise this devouring function he termed phagocytes.

Various objections have been urged against Metchnikoff's views, but so far as I am able to judge, he has met these effectively by his masterly series of researches; and his observations have been confirmed and extended by several independent investigators.[1] For the sake of those among my audience who may chance not to be familiar with Metchnikoff's work, I am tempted to relate briefly some of his experiments. The green frog, below the temperature of 20° C. (68° F.), is incapable of taking anthrax: the bacilli of that disease cannot grow when introduced under the skin of that animal. To what was this immunity of the frog to anthrax due? Were its juices an unfit pabulum for the microbe, or was the phagocytic action of its leucocytes the explanation? In the hope of solving this question Metchnikoff formed a tiny bag out of the pith of the reed, and having placed in it some spores of anthrax, closed the bag and inserted it beneath a frog's skin. The pith wall of the bag allowed the animal's lymph to penetrate by diffusion, but excluded the leucocytes; and the result was that the spores sprouted and grew into luxuriant threads of anthrax in the lymph, which was thus proved to be a suitable medium for the growth of the bacillus. Meanwhile under another part of the skin of the same frog had been placed a small piece of the spleen of an animal that had just died of anthrax and contained the microbe in its most virulent form; but there, the leucocytes having free access, no growth occurred.

Another experiment on the same principle was still more instructive. It consisted in introducing the spores of anthrax into the anterior chamber of the eye of a frog, which, as we have seen, is naturally insusceptible of the disease, and also into that of a sheep and of a rabbit made insusceptible of it artificially by "vaccination" with Pasteur's attenuated virus. The aqueous humor of the healthy eye contains few if any leucocytes to interfere with the perfect transparency essential to vision. Accordingly the spores sprouted and grew for a while freely in the anterior chamber. Meanwhile the growth of the bacillus occasioned irritation to the eye, resulting in the immigration of a constantly increasing number of leucocytes, producing turbidity and in time hypopion. If a drop of the

aqueous humor was withdrawn at an early period after the commencement of the experiment and examined with the microscope, it was found to contain anthrax bacilli; some of them free in the liquid, but others inclosed in the bodies of leucocytes. But a drop taken after a longer period had elapsed showed no free bacilli, all being now within the leucocytes and exhibiting signs of degeneration in various degrees as the result of their advancing digestion. Finally the anthrax disappeared entirely and the eye cleared up, the animal in all cases remaining healthy, although inoculation into the aqueous humor proved a peculiarly deadly mode of infecting a susceptible animal.[2]

Here we see that the inflammation excited by the microbe becomes, through the medium of the leucocytes, the cause of its destruction. How little can the lamented Cohnheim have dreamed that his observation of the emigration of leucocytes in inflammation would prove to have so far-reaching a bearing upon the pathology of infective diseases.

I have brought before you two samples of the kind of evidence upon which the phagocyte theory rests; and if we accept it, as I believe we must, it serves at once to explain much that has hitherto been mysterious in the relations of micro-organisms to wounds. Take for example that which the surgeon makes for the cure of harelip. Its posterior edge is perpetually bathed with the saliva, which contains many kinds of septic bacteria. But these do not enter and people the fibrin that glues together the cut surfaces, as they infallibly would do if those surfaces were composed of glass or any other chemically inert material destitute of life. It has long been very evident that the living tissues exerted a potent influence in checking bacteric development in such a wound: but what was the nature of that influence? This used to be an enigma, but now receives its natural explanation in the phagocytic action of the cells that crowd the lymph soon after its effusion.

At the London Congress I brought forward an experiment which proved that a blood-clot within the body may exert a powerful anti-bacteric agency. I will not repeat the details of that experiment further than to say that a very small piece of linen cloth soaked with putrid blood was mounted by means of silver wire in the interior of a short glass tube open

at both ends, which was slipped into the jugular vein of a donkey and kept in position between two ligatures. After two days the venous compartment was removed and the coagulum within it investigated. In and near the glass tube it was in a state of advanced putrefaction, as was indicated by its foul odor and greatly altered appearance; and microscopic examination showed that it abounded with bacteria. But near the wall of the vein it looked to the naked eye like a recent clot; I could not detect in it any putrid odor nor could I discover bacteria with the microscope.[3]

Stained sections of these outer parts of the coagulum, made after hardening in alcohol, showed great multitudes of cells differing from one another in size and other characters, just as is often the case with Metchnikoff's phagocytes. I supposed that these cells must have been in some way or other the anti-bacteric agents; but how, I could not imagine. The phagocyte theory clears up the mystery.

By means of this same theory we can account for what would otherwise have seemed to me incomprehensible—the use, without evil consequences, of silk ligatures which have not been subjected to any antiseptic preparation. We learn from the experiments of Ziegler and others that leucocytes soon penetrate very thin spaces between plates of glass or other chemically inert foreign bodies inserted among the tissues. And we can understand that they may creep into the intervals between the fibres of a silk thread and destroy any microbes that may have lodged there, before they have had time to develop serious septic mischief. But there must surely be a limit to the thickness of the threads. No one, I imagine, would feel justified in leaving in the peritoneal cavity an unsterilized cord as thick as a finger. Mr. Bantock, whose remarkable series of successful ovariotomies may seem to justify his practice, does not, I believe, prepare his ligatures antiseptically; and I understand that he uses, for tying the pedicle of the tumor, silk twist of so strong a nature that it can be trusted to bear the needful strain with a diameter of only about one-thirtieth of an inch. But it would surely be wiser to sterilize even so slender a cord. Who can say that septic mischief may not occasionally lurk in the ligature in a form which may baffle the phagocytes?

The success in abdominal surgery achieved by Bantock

and Lawson Tait, without, as it is said, the use of antiseptic means, proves a stumbling-block to some minds. But in truth the practice of these surgeons is by no means conducted without antiseptic precautions; nor would they, I am persuaded, desire that such an impression should prevail. Both are scrupulously careful in the purification of their sponges; and if there is one thing more important than another in the antiseptic management of wounds of the peritoneum, it is the avoidance of impure sponges. Both observe the strictest cleanliness, which is surely an antiseptic precaution, for it owes its virtue to the fact that it presents the septic organisms in the smallest possible numbers and thus reduces their power for evil to the utmost that can be done by any measures that are not germicidal. Both these surgeons also wash out the peritoneum with water, so as to get rid of coagula without injuring the peritoneal surface by rubbing it with sponges; and this is done in order to avoid the risk of sepsis in residual clots. The drainage of the peritoneum is another antiseptic measure, and Mr. Bantock, I am informed, has the sponges which absorb the serum wrung out of sulphurous acid and changes them very frequently.

This is a department of surgery in which I have had but little personal experience. But I can see that while the measures to which I have referred are, so far as they go, highly valuable, it must be in itself a very desirable thing to avoid the direct application to the peritoneum of strong and irritating antiseptic solutions. But now that we are all agreed that microbes are the evil with which we have to contend, it is surely wiser to insure by germicidal means their entire absence from our hands and instruments, rather than trust to the most perfect cleanliness in the ordinary sense of the term. And if water is used for washing out the peritoneum, prudence seems to me to dictate that it ought to be freed from living organisms if this can be done without making it irritating. This object is, I believe, aimed at by Mr. Bantock by boiling the water before using it; but I would advise as more effectual an extremely weak solution of corrosive sublimate, such as 1 in 10,000, which, as Koch has taught us, may be implicitly trusted as aseptic, while it is not appreciably irritating and involves no risk of mercurial poisoning.

In general surgery the direct application of strong anti-

septic solutions is not attended with the same disadvantages as in operations in the peritoneal cavity. My practice for some time past has been to wash the wound, after securing the bleeding points, with a pretty strong solution of corrosive sublimate (1 to 500) and irrigate with a weaker solution (1 to 4,000) during the stitching; and I have had no reason to complain of the results. To this, however, I must make one marked exception. When applied to the healthy synovial membrane of a joint, the 1 to 500 sublimate lotion produces inconvenient irritation; and therefore when opening an articulation, as for suturing a transverse fracture of the patella, I abstain from the washing, and, as a substitute, have hitherto irrigated during the whole operation with the weak solution (1 to 4,000).

And yet I must confess that I have for a long time doubted whether either the washing or the irrigation is really necessary. These doubts have been raised partly by experiments, some of which I mentioned at the London Congress, which had proved to me that normal blood and serum, and even pus, were by no means favorable soils for the growth of microbes in the form in which they are present in the air; and partly by reflection upon the experience we had when we used the carbolic spray.

As regards the spray, I feel ashamed that I should have ever recommended it for the purpose of destroying the microbes of the air. If we watch the formation of the spray and observe how its narrow initial cone expands as it advances, with fresh portions of air continually drawn into its vortex, we see that many of the microbes in it, having only just come under its influence, cannot possibly have been deprived of their vitality. Yet there was a time when I assumed that such was the case; and trusting the spray implicitly as an atmosphere free from living organisms, omitted various precautions which I had before supposed to be essential. Thus in opening the pleura in empyema for the purpose of evacuating the pus and introducing a drainage-tube, and afterward in changing the dressings, I had previously applied over the opening a piece of cloth steeped in an antiseptic lotion to act as a valve and prevent the entrance of air during inspiration. But under the spray I omitted the valve and allowed the air to pass freely in and out of the pleural cavity, although I used the spray at

such a distance from the producing apparatus that it was dry and transparent, with the particles of carbolic solution necessarily widely separated from each other. And these particles cannot have been in more than instantaneous contact with much of the dust before it was drawn within the chest and securely protected by the pus or serum there from any further action of the antiseptic. It is physically impossible that the microbes in such dust can have been in any way whatever affected by their momentary presence in the spray.

Yet we did not find our results in the treatment of empyema rendered worse by this false confidence in the spray. There are few more beautiful things in antiseptic surgery, as contrasted with the results of former practice, than to see the abundant purulent contents of the pleural cavity give place at once to a serous effusion rapidly diminishing from day to day till, the opening being allowed to close, the pleura, restored to its healthy condition, resumes its normal function of absorbing gases and, as the natural vacuum within it becomes re-established, the atmospheric pressure blows up the contracted lung and brings it again into contact with the chest wall unimpaired in its dimensions. Such a course we had witnessed before the days of the spray and such we continued to see during its use.

If, then, no harm resulted from the admission day after day of abundant atmospheric organisms to mingle unaltered with the serum in the pleural cavity, it seems to follow logically that the floating particles in the air may be disregarded in our surgical work. And if so, we may dispense with antiseptic washing and irrigation; provided always that we can trust ourselves and our assistants to avoid the introduction into the wound of septic defilement from other than atmospheric sources.

Since we abandoned the spray, three years ago, we have been careful to compensate for its absence, not only by antiseptic washing and irrigation, but by surrounding the seat of operation with wide spread towels wrung out of an antiseptic solution. For the spray, though useless for the object for which it was originally designed, had its value as a diffuse and perpetual irrigator, maintaining purity of the surgeon's hands and their vicinity as an unconscious care-taker. But if besides the spray we give up all washing and irrigation of the wound,

our vigilance must be redoubled. Yet I believe that with assistants duly impressed with the importance of their duties, the task would prove by no means difficult. I have not yet ventured to make the experiment on any large scale, though I have long had it in contemplation. It is a serious thing to experiment upon the lives of our fellow-men! But I believe the time has now arrived when it may be tried. And if it should succeed, then perhaps may be fulfilled my early dream. Judging from the analogy of subcutaneous injuries, I hoped that a wound made under antiseptic precautions might be forthwith closed completely, with the line of union perhaps sealed hermetically with some antiseptic varnish. And bitter was my disappointment at finding that the carbolic acid used as our antiseptic agent induced by its irritation such a copious effusion of bloody serum as to necessitate an opening for its exit. Hence came the drainage of wounds. But if we can discard the application of an antiseptic to the cut surfaces, using sponges wrung out of a liquid that is aseptic but unirritating, such as the 1 to 10,000 solution of corrosive sublimate, we may fairly hope that the original ideal may be more or less nearly attained.

We have already made of late considerable approaches toward it. Our wounds being no longer subjected to the constant irrigation of the spray, and carbolic acid having given place to the less irritating, though more efficient, solutions of corrosive sublimate, serous discharge is much less than formerly and less drainage is required. In many small wounds where we used to find drainage imperative, we omit it altogether, and in those of larger extent we have greatly reduced it. Thus after removing the mamma and clearing out the axilla, I now use one short tube of very moderate calibre where I used to employ four of various dimensions. But it would be a grand thing if we could dispense with drainage altogether: without applying the very firm elastic compression adopted by some surgeons, which, besides involving the risk of sloughing of parts of low vital power, with the chance that it may after all fail in its object, proves often extremely irksome to the patient.

It remains for me to say a few words regarding the best form of external dressing. Some surgeons have thought that simplicity and efficiency may be combined in the maximum

degree by the use of cotton wool sterilized by heat. But though it may be a simple thing to heat the wool appropriately by means of suitable apparatus in a public institution, for the ordinary practitioner it would be impracticable. And as regards efficiency I need hardly remark that cotton wool merely aseptic can only exclude septic mischief when it is in the dry state. When it is soaked to its external surface with a copious discharge, it must be liable to become septic *en masse*. And however well we may succeed in the future in diminishing or abolishing discharge from wounds made by the surgeon, there must always remain cases in which it will occur in greater or less amount. Contused wounds, for example, into which dirty material of one kind or another has been introduced before they are seen by the surgeon, must be purified by the use of powerful antiseptic means and must for a while discharge freely. The same is to be said of cases in which we make the attempt, often with signal success, to restore an aseptic condition in a part affected with septic sinuses. Again, there are abscesses in which, in the present state of our knowledge, we cannot avoid the occurrence of considerable serous oozing, and in which a perfectly trustworthy antiseptic dressing is a matter of life and death. And wherever discharge is considerable, it is essential that the dressing be of a kind which will not permit the development of septic organisms in it, although it be saturated throughout; and this can, I believe, only be attained by the use of chemical antiseptic substances. I have for some time past employed for this purpose a combination of the two cyanides of zinc and mercury, which appears to fulfil the requisite conditions of antiseptic efficacy and due storage of the agent in spite of free discharge, together with absence of irritating properties. Having already published on this subject, I will not detain the members of the congress with details regarding it, further than to say that since the date of that publication Professor Dunstan, of the London Pharmaceutical Society, has devised means by which the substance can be prepared in a perfectly definite manner, and containing twice as great a percentage of the cyanide of mercury as that which we have hitherto used. And as I have ascertained that the cyanide of mercury is the more important ingredient antiseptically, and also that its larger amount in Dunstan's material does not make the salt irritat-

ing, we may fairly regard the new preparation as an improvement.

And yet we have had no need to complain of this substance in the form in which we have used it hitherto. Those who have followed my practice at King's College Hospital during the year and a half in which this dressing has been employed, will agree with me that we have secured a constancy of aseptic results which has more than ever justified the performance of operations once quite unwarrantable.

In thus referring to my own work, I do so in no boastful spirit; but in the hope of stimulating some of those whom I address to more thorough earnestness in pursuit of the great objects of antiseptic surgery.

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CANCER

AND ITS COMPLICATIONS.

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CANCER AND ITS COMPLICATIONS.

CHAPTER I.

TUMORS AND CANCERS.

THIS work has been written to elucidate the following points:

1. Cancer is a local disease.

2. There are several varieties of cancer, distinguishable from one another by their microscopic character; but the degree of malignancy of a cancerous growth depends not merely upon its structure, but upon its anatomical site.

3. Cancer frequently occurs in combination with some other disease, and is often preceded and caused by disease or injury of the tissue from which it springs.

4. The occurrence of cancer may often be prevented; and complete extirpation of the disease in its earliest stage may be considered curative.

5. Further investigation of the action of certain specific drugs—among other things—is still needed. Evidence which has been advanced in favor of the curative action of some mineral and vegetable substances cannot be disregarded.

A tumor is a neoplasm, or new growth, of abnormal character, which usually can be distinguished from the normal tissue from which it springs by its boundaries and diversity of structure, and which is not the result of inflammation only.

But the term is often used in a far wider and in its strictly etymological sense, viz., to denote any "swelling;" for although this wide use of the word is abandoned by surgical writers, yet, whether properly or improperly, it is frequently

so employed for practical or diagnostic purposes in actual practice. For diagnostic purposes the pregnant uterus must be considered a tumor until it has been distinguished from an ovarian or other abdominal tumor. Similarly an abscess may be considered a tumor until distinguished from a sarcoma.

All tumors or neoplasms are divided into two main classes, viz., the malignant and the non-malignant, innocent, or benign.

For very good reasons, the malignant tumors are the cancers; and cancer or malignant disease are synonymous terms. Therefore every cancer is a tumor, but a tumor is not necessarily a cancer.

Cancer, or malignant disease, commences locally as a distinct focus or new growth, whose component cells have arisen from normal cells, and which begin to infiltrate and consume healthy adjacent cells, the new growth sometimes generalizing by the lymphatic and sometimes by the vascular system.

A malignant or a non-malignant tumor may originate from nearly any part of the body; but while the latter in its growth will merely displace the surrounding tissues, the former will invade and consume them. A non-malignant growth will not disseminate by the lymphatic or vascular system, or recur locally after extirpation.

Local recurrence of a cancer after extirpation is nearly certain, unless considerable portions of the tissues apparently healthy, adjoining the growth, have been also destroyed or removed.

All tumors may ulcerate, but a distinction must be pointed out between the ulceration of an innocent and of a malignant tumor.

The ulceration which is sometimes found associated with an innocent tumor is of an accidental kind, and due to injury or defect in the blood-supply of the growth, and is not of a progressive nature.

But the ulceration of a cancerous growth is part and parcel of the disease, and one of the most striking features in its natural history. Growth is construction, and ulceration is destruction of tissue; the one process is the opposite of the other; where they coexist or alternate progressively, the diseased area increasing in size and extent, there is cancer. The débris cast off, while ulceration is proceeding, in the form of discharge, is of an offensive and foul character. The foulness

of the discharge may be said to be in direct ratio to the rate of destruction of the tissue.

Cancer disseminates in various ways.

First, satellite growths may arise in the immediate neighborhood of the parent growth.

Secondly, particles from the primary or parent growth may be carried along the lymphatic vessels into the lymphatic glands, constituting secondary or daughter neoplasms.

Thirdly, particles of the primary growth may penetrate the walls of the blood-vessels, and give rise to secondary growths in distant organs.

Fourthly, the disease may become disseminated by grafting; particles becoming implanted from a primary growth to some other part of the body temporarily in contact with such growth; from one part of the peritoneum to another; and sometimes from husband to wife.

Individuals, therefore, frequently present themselves suffering from multiple cancerous developments--the secondary or metastatic formations being generally recognized, if occurring near the surface of the body, by their anatomical continuity with the parent growth; or their existence in the interior may be surmised.

Metastatic formations are always, and necessarily, of the same histological variety as the primary growth.

When malignant disease occurs primarily at more than one part or organ, the different growths are not necessarily of the same histological variety.

In such cases the diseased foci may be either symmetrically or asymmetrically situated.

The occurrence of cancer primarily in both breasts is rare, but such a manifestation should not be construed as indicating a constitutional origin, but rather as an instance of a local disease attacking independently two organs symmetrically situated, and placed under similar predisposing circumstances.

In addition to the ucleration referred to, other retrogressive changes may occur in neoplasms. The growth may undergo fatty, colloid, gangrenous, or caseous degeneration. Ossification, too, may occur.

In cancer, should the destructive or ulcerative factor exceed in rate the constructive factor in the disease, the neoplasm will destroy itself and a spontaneous cure result. Whether

such cases ever really occur, though descriptions of them may be found sparsely scattered in surgical literature, is a controversial topic; but I am sorry to say I have never seen examples of what from theoretical considerations would be anticipated.

Patients suffering from cancer are often found in the best general health, and it is only in the ulcerative stage, when deleterious or putrefactive products may become absorbed, that constitutional disturbance may arise. Such a condition is termed the cancerous cachexia, but there is nothing special about it. The cachexia will frequently disappear after the disease has been extirpated by operation, or the foulness of the discharge, which poisons the system, destroyed by antiseptic agents.

When cancer has once commenced, its duration, if unchecked, varies from a few months to many years. The rapidity of growth will vary with the part of the body first attacked and the histological variety of the disease. In the majority of cases of cancer, however, which fall under our notice, the duration of the disease must be measured by years, even if only temporarily checked, as only too commonly happens, by inadequate operations, or those which have not been performed sufficiently early.

Death, when it supervenes, results from the mechanical pressure of the primary neoplasm or of the secondary growths upon some vital part, when danger will be apprehended by the anatomical relation of the tumor to such part; from blood-poisoning and exhaustion, or from hemorrhages, either small and repeated from the growth itself, or profuse, resulting from the extension and ulceration of the growth into some large-sized blood-vessels.

Cancer is a disease which is found in all periods of life, though the vast proportion of cases occur in persons aged between forty-five and sixty-five years. Cancer rarely occurs under twenty or over seventy-five years of age; nevertheless none are too old or too young to be attacked by cancer. (When malignant disease occurs in childhood and in youth, it is usually as sarcoma.)

Statistics show that the annual mortality from cancer is increasing, both actually and relatively to the population.

CHAPTER II.

THE VARIETIES OF CANCER.

CANCERS are divided into two main groups, the carcinomata and the sarcomata, each of which presents sub-varieties. This mode of classification is based upon the circumstance that during the development of the embryo, the blastoderm presents three layers, viz., the epiblast, mesoblast, and hypoblast. Embryology teaches us that from the cells of which the trilaminar blastoderm consists (all having arisen from a common parent cell, the ovum) eventually is developed the entire body, all parts of which can be traced in origin to one of the three layers mentioned. When a cancer originates from a part of the body developed from either hypoblastic or epiblastic cells the growth is termed a carcinoma; if from cells derived form mesoblastic tissue, a sarcoma.

Carcinomata are composed of groups of epithelial cells imbedded in a vascular framework of connective tissue. The cells multiply endogenously and lie together in confused masses.

The sarcomata which arise from parts derived from the mesoblast are composed of cells which do not ordinarily lie in alveoli, or spaces (as in the case of the carcinomata); the cells predominating over the intercellular substance, thus resembling immature connective tissue. So far, the division between the two main groups of cancer can be formed easily enough, but unfortunately it is not always practicable to say from which of the blastoderm layers a neoplasm has arisen. Moreover, encephaloid carcinoma (so called) is perhaps generally a sarcoma, and the rare cases of alveolar sarcoma are most difficult to distinguish from carcinoma. But, taking all in all, this primary division is the most useful and modern classification, and the primary divisions may for descriptive purposes be subdivided as follows:

Varieties of Carcinoma.

1. Scirrhus.
2. Medullary.
3. Melanotic.
4. Osteoid.
5. Cylindroid.
6. Colloid.
7. Epithelioma.

Sub-variety, Rodent ulcer.

Varieties of Sarcoma.

1. Round-celled.
2. Spindle-celled.
3. Giant-celled.

Special variety, Epulis.

4. Mixed-celled.
5. Melanotic.
6. Hemorrhagic.
7. Lymphoma.
8. Glioma.
9. Psammoma.
10. Myxoma.

Scirrhus, or Hard Cancer.

Latin equivalent, scirrhus. French equivalent, squirrhe. German equivalent, scirrhus. Italian equivalent, scirrho.

Scirrhous cancer originates from the epithelium of the tubular or acinous glands, notably of the breast, pylorus, and pancreas.

The growth consists chiefly of fibrous tissue, inclosing clumps of cells within alveoli, and derives its name from the toughness and quantity of its fibrous element. The cells are large in size, with large nuclei, and are polymorphous from mutual pressure. Scirrhus is first circumscribed, but soon commences to spread from the periphery, infiltrating the adjacent tissues and puckering the region in which it grows, the infiltrated parts contracting. Dimpling of the skin (in the case of the tumor subjacent to it) therefore appears, and the tumor becomes adherent to the skin as well as to the parts beneath it. The contraction of the scirrhus gives rise to pain from implication of the nerves involved in it; the pain is described as of a stabbing, paroxysmal, and lancinating character; the other pressure-symptoms will vary with the site of the growth. After the skin has become involved it generally presents a dusky color, and sometimes there is desquamation. Distinct cancerous nodules may appear in the skin; should this structure become hard and brawny, the term "cancer en cuirasse" is applied to it. Ulceration may follow, and the ulcer presents these characters: it is of irregular outline and generally solitary; its edges are dusky, hard, usually everted

and nodular; its surface is irregularly excavated; its discharge is fœtid, semi-purulent, hemorrhagic or sanious; and, according to Gross, the carcinomatous fungus hæmatodes of the older writers is apocryphal. Scirrhus grows chiefly in the direction of its best blood-supply, and increases in size by continuity. It disseminates by the lymphatic system, the glands on the proximal side of the tumor which lie nearest to the growth becoming first involved, and the lymphatic vessels which unite the tumor with the glands are indurated, and sometimes stand out like cords. The implication of the glands may be of a scirrhous or medullary character; if a cluster of glands be affected they become fused together, the new growth running a similar course to the primary lesion.

The cancerous cachexia is commonly said to become established after the disease is well advanced, and to be due to the exhaustion consequent upon it, and caused by various factors, viz., the hemorrhages from the growth, if it be ulcerated, the debility produced by the local discharges and the absorption into the system of septic material; by sleepless nights, by malnutrition, and by anxiety.

Important though the cancerous cachexia be from a diagnostic point of view, yet it is most frequently confounded with cachexia due to other conditions, viz., to that of Bright's disease; various forms of chronic anæmia, especially pernicious anæmia; icterus, syphilis, the pigmentation caused by Addison's disease; and though the differential diagnosis may often be arrived at by an elimination of these conditions, yet, given an absence of unequivocal signs and symptoms of cancer, the presence of a cachexia will often prove of great value in confirming an opinion.

Medullary.

Latin equivalent, carcinoma medullosum. French equivalent, cancer médullaire. German equivalent, Markschwamm. Italian equivalent, cancro midollare.

Medullary or encephaloid carcinoma constitutes, according to Gross, about five per cent of all the varieties of cancer. It is generally met with in the testis, breast, kidney, liver, and ovary. Histologically, the difference between medullary and scirrhus carcinoma is merely one of degree in the comparative relationship which subsists between the epithelial elements

and the fibrous stroma; for while in the latter the
largely in excess of the cells, in the former the pro
reversed and the cells are greatly in excess of th
giving the neoplasm a much softer consistence, w
sometimes be mistaken for the fluctuation of an ab
imparting to it a far quicker rate of growth. Clin
cephaloid cancer is often met with at an earlier per
than scirrhus, sometimes below the age of puberty,
rhus is not; and while the greatest number of cas
variety attacks people in the fifth decade, a large
that are met with in the fourth. From scirrhus,
cancer differs in the larger size to which it attai
greater prominence of its superficial veins, and in it
readiness to give rise to metastases or secondar
Thus the lymphatic glands become implicated ea
course of the disease, and secondary growths, which
ally originate *de novo*, or else by infection from
tumor, not infrequently appear in organs distant
primary lesion.

Encephaloid cancer is really a rare variety, for m
cases so tabulated are, in point of fact, instances
celled sarcomata.

Melanotic.

Latin equivalent, carcinoma melanoticum. Fren
alent, mélanose. German equivalent, melanotisch
Italian equivalent, cancro melanotico.

Melano-carcinomata are much rarer than mel
mata. They are carcinomata in which a deposit
ment has taken place, giving the tumor a black or
pearance.

Osteoid.

Latin equivalent, carcinoma osteoides. French e
cancer ostéoïde. German equivalent, osteoid Krebs
equivalent, cancro osteoide.

By osteoid carcinoma is understood a cancer whic
dergone ossification. It is still maintained by son
that carcinoma is often met with in the bones, and
tumors not infrequently ossify. Histologically, lit
ence can often be found between carcinomatous and

tous tumors of bone; so that the differential diagnosis between these neoplasms cannot be made.

But proceeding upon the basis that sarcomata are neoplasms of connective tissue and carcinomata of epithelial origin, it follows that it would be logically impossible for primary carcinoma of bone, the carcinomatous deposition originating in the bone, to occur, and therefore the term "osteoid carcinoma" could not be applied to the ossification of a tumor which commenced in bone (as it generally does), but only to an ossification of a carcinoma occurring in other structures. On the other hand, Mr. Timothy Holmes points out, in the "System of Surgery," Vol. II., p. 315, that it is an assumption to say there is no epithelium in the bones, "since the vascular endothelium may be considered epithelial." But this is a most ingenious *petitio principii*, and, were it admitted, the entire distinction between carcinoma and sarcoma would at once fall through; for since all the connective tissues are permeated by blood-vessels, carcinoma might originate in any connective tissue, viz., from the endothelium of its vessels. Moreover, the vascular endothelium is of mesoblastic development.

With reference to these tumors, Mr. Holmes points out further, in defence of his classification of them among the carcinomata, that they "present none of the features which were originally described as characteristic of sarcoma, for they are usually highly malignant, and recur not locally, but in remote parts; and they invade the lymphatic glands, often at an early period of the disease. But in striking contrast to these very malignant osteoid tumors, which I would still call osteoid 'cancers,' there are others which are only locally malignant —*i.e.*, recurrent—which do not threaten life unless by their pressure, and which in all clinical respects bear the strongest analogy to the 'recurrent fibroid' tumors of Lebert and Paget. Such cases I would class apart from the cancerous tumors by some such term as 'diffused bony' or 'recurrent osteoid' tumors."

Cylindroid; *syn.* Adenoid.

Latin equivalent, carcinoma cylindroides *vel* adenoides. French equivalent, cylindroïde, *syn.* adénoide. German equivalent, Cylindrom, *syn.* Adenoid. Italian equivalent, cilindroïde, *syn.* adenoide.

Cylindrical carcinoma presents groups of cells of which those at least at the periphery of the cluster are cylindrical in form. The cells which occupy the interior of the groups are generally polymorphous, the centres of the loculi being often empty—a circumstance which could be explained by the dropping out of the central cells in making the microscopic sections. Cylindromata are formed from those cells which clothe the mucous membranes, and the growths are usually met with in the rectum, sigmoid flexure, other parts of the intestine, and uterus. The neoplasms are found in various stages of development, some closely simulating the higher organization of the adenoid tumors, with which they have been confounded, in some cases the distinction being most difficult; but a true cylindroma is not encapsuled. The tumor is of comparatively slow growth, and is apt to disseminate chiefly by the liver and lungs.

Colloid.

Latin equivalent, morbus colloides. French equivalent, cancer colloïde. German equivalent, Gallert-Krebs. Italian equivalent, cancro colloide o gelatinoso.

It is very doubtful whether colloid cancer ever occurs as a primary growth. Colloid is usually regarded as a degeneration of one of the varieties of cancer, and not as a distinct species. As to formation, the cancer cells enlarge and become partially filled with clear colloid or glue-like material. The alveolar structure of the neoplasm is generally well marked, and a jelly-like substance (gelatiniform) exudes on squeezing a section of the growth.

Colloid cancer pursues a slow course; it is most commonly found in the omentum and abdominal viscera. It is more than probable that the sarcomata as well as the carcinomata undergo colloid change, in proof whereof may be cited an instance of primary malignant disease of the bones,[1] of colloid character, and therefore presumably sarcomatous.

Epithelioma.

Latin equivalent, epithelioma. French equivalent, cancer épithélial. German equivalent, Epithelial-Krebs. Italian equivalent, cancro epiteliale.

Epithelioma is that variety which originates from the epithelium of the skin or mucous membrane, and is most commonly met with at the points of junction of these structures. The appearance of epithelioma at such a site is very often attributed to the presence of a fissure or excoriation, or to the result of some slight injury. Nevertheless, the rich blood-supply with which the muco-cutaneous junction and the mamilla are endowed would in itself render these parts specially prone to epithelial infiltration.

Epithelioma commences by presenting aggregated cells, similar to those of the Malpighian layers. The deeper tissues become invaded by clumps of cells—just as, in the development of the ova, groups of cells from the germ epithelium first sink into the ovarian stroma. These processes having entered the corium and the subjacent structures, often cross or unite by branches. The cells which compose these plugs are very firmly pressed together in some places, so that a cross-section of them yields the so-called "bird's-nest" bodies, or "epidermic globes."

Nevertheless, these bodies are not pathognomonic of epithelioma; or perhaps, more properly speaking, they point out the relationship which subsists between the various neoplasms and normal growths—for the nest-cells of the epithelioma cannot be distinguished *per se* from those met with in some papillomata, or even in the covering of the healthy tongue.

Ulcers form from the breaking down of the deposit, and present certain characteristic features. The edges of the ulcer are rugged, hard, nodulated, and everted. The surrounding area is inflammatory and indurated. From the roughened base of the ulcer proceeds a foul discharge which exhibits a tendency to scabbing. Epithelioma is a slow-growing variety of cancer. At the present moment there is a case under the care of the author of epithelioma of the right breast, the growth being of six years' duration. The axillary lymphatics have become involved during the past twelvemonth. It is also noteworthy, with regard to the etiology of cancer, that all the children of the woman were suckled solely from the right breast.

Epithelioma usually commences as a small crack, fissure, or ulcer, and often in a crack, fissure, or ulcer—*i.e.*, the growth may appear in a certain form on a structure previously

healthy, or more frequently may develop out of some morbid condition of apparently trivial character.

Thus the simple fissure of the anus; the simple crack on the lip, caused by the irritation of the rough or broken pipe-stem or decayed tooth; the patch, plaque, or ichthyotic spot on the tongue, so often of syphilitic origin; the common scar-tissue, the common erosion of the cervix uteri, or the skin already infiltrated by a lupoid growth—each of these conditions forms the most fertile predisponents for cancerous deposit.

Out of these facts two things are manifest: first, that the diagnosis, by the naked eye, of epithelial deposit in its very earliest or premonitory stage is impossible; and, secondly, the important prophylactic point, viz., that the greatest care should always be exercised in the observation and treatment of "suspicious-looking" ulcers, fissures, and patches, especially if accompanied by a slight infiltration of the parts, or if syphilitic or other taint exist.

Epitheliomatous cancer is rarely met with in patients under thirty years of age. Its most common seats are the lip, tongue, œsophagus, stomach and intestines, breast, genital organs, and anus. The rate of growth varies with the region primarily affected. The disease disseminates through the lymphatic system; but secondary growths appear in the lungs, liver, kidneys, and other organs.

Rodent Ulcer; *syn.* Jacob's Ulcer.

Latin equivalent, ulcus erodens. French equivalent, ulcère rongeur. German equivalent, ulcus rodens. Italian equivalent, ulcera rodente.

Rodent ulcer is a sub-variety of epithelioma, usually occurring on the upper two-thirds of the face, and distinguished pathologically by the presence of certain glandular cell-masses, connected with the hair-follicles and sebaceous glands.

Rodent ulcer usually attacks people advanced in life, and the nasal side of the lower eyelid is its usual seat. The growth commences as a small nodule, which very slowly ulcerates. The edges of the ulcer are hard, regular, sinuous, and inverted. Its base is smooth and clean and its discharge slight. As the disease progresses, the orbit usually becomes implicated. The eyeball may slough out, and the bony framework of the

orbit and nasal cavity having become involved, communication with the nasal fossæ and antrum is at last established.

This sub-variety runs a peculiarly slow course, and is further distinguished from epithelioma by its physical characters, by its site, by an absence of glandular implication, by good general health, by an absence of pain and usually of cachexia—the discharge being insignificant. As to the origin of rodent ulcer, all pathologists agree that it springs from epithelium.

Thiersch, followed by Drs. Tilbury and Calcott Fox,[2] believed that the growth commences from the external root-sheath of the hair-follicles, which in point of fact is an extension of the rete Malpighii. Dr. Thin, on the other hand, considers Jacob's ulcer to be a cancerous adenoma of the sweat-glands.[3]

Dr. Hume, who has devoted great pains to the task of elucidating the origin of rodent ulcer[4] by means of the careful study of microscopic sections of a few cases, favors the former view; but these specimens, which are admirably illustrated in the "British Medical Journal,"[5] would seem to support the view that rodent ulcer may arise either from the hair-follicles or sebaceous glands. According to Dr. Hume, however, "the first appearance of disease is noticed in a broadening from increased cell-formation of certain hair-follicles. The portion of the follicle seems usually to be the neck, or that part between the opening of the sebaceous gland into the follicle and the epidermis. The canal of these broadened follicles usually widens, producing an elliptical cavity in the section. In some follicles the broadening is not general, but takes the form of a distinct outgrowth from the edge, and in such the connection of the outgrowth with the external sheath of the follicle can be plainly traced." These changes are followed by increased vascularity in the corium, by the transudation of leucocytes, and, later, by œdematous infiltration. The diseased follicle, with its sebaceous gland, assumes a deeper position, becomes constricted, and finally broken off. It is this deeper portion which is transformed into a patch of rodent tissue by cell-proliferation.

In the sebaceous glands the process begins by proliferation of their sheaths, which are diverticulæ from the sheaths of the hair-follicles. The ucler is formed by atrophy of the epi-

dermis superficial to the patches of rodent tissue. But in some cases, viz., in those accompanied by inflammation, there is considerable (secondary) thickening of the epidermis.

Dr. Hume, in opposition to Dr. Thin, maintains that the changes in the sweat-ducts and glands are of a secondary and not of a primary character—that they are changes of disintegration, not of growth.

"In epithelioma," writes Dr. Hume, "there is a marked tendency to an unrestrained cell-infiltration of surrounding structures, so that infection of the lymphatic system readily occurs. The cell-growth of rodent ulcer, on the other hand, is in the form of isolated masses which, originating in the follicles and sebaceous glands, are, at least for some time, restrained by the fibrous sheaths of these structures. The tendency of these masses is, therefore, to cause by their pressure on the tissues a persistent ulceration, in which they, as well as the tissues, perish. But because this local destruction takes place rapidly, and because of the absence of cell-wandering, lymphatic infection is not prone to occur."

These facts would tend largely to support the view of Mr. Jonathan Hutchinson, that no essential difference exists between epithelioma and Jacob's ulcer, and that the clinical and microscopic discrepancies between these conditions are explicable on consideration of the locality of rodent ulcer—*i.e.*, in a situation where sebaceous glands abound.

In the summer of 1883 the author saw a patient who had been affected for many years with a typical Jacob's ulcer involving the orbit; but since the commencement of the year a distinct epithelioma had developed in the lower lip. This isolated case confirms strongly Mr. Hutchinson's views as to the relationship of these diseases.

Sarcoma.

Latin equivalent, sarcoma. French equivalent, sarcome. German equivalent, Sarcom. Italian equivalent, sarcom.

Definition.—A sarcoma is a tumor of connective-tissue origin, composed of elements which are for the most part cellular and embryonic. These elements are imbedded in a matrix of intercellular substance of varying quality and quantity. The vessels run between the cells, and the cells increase in number by division (Butlin).

When malignant tumors occur during young life they are generally sarcomata. Clinically, sarcomata present many features in common with the carcinomata; and as in carcinoma wide differences in the natural history of the growth, dependent on the variety and site, exist, so in sarcoma the rate of progress and degree of malignancy will be found to vary with the locality and anatomical character of the neoplasm.

A sarcoma is usually a more or less encapsulated tumor, which can be readily "shelled out" of or peeled off from the structures with which it is connected. However, the tumor really extends beyond its apparent boundaries, so that during an operation for its removal a considerable amount of the surrounding tissues should be excised also.

In outline, sarcomatous neoplasms are generally rounded or ovoid—not often lobulated; in consistence, elastic; distinct fluctuation, simulating that of an abscess, may be met with; on the other hand, there are solid varieties. The subjacent structures are not infiltrated, and the skin is not adherent to the tumor. Sarcomata usually attain far larger dimensions than carcinomata. The subcutaneous veins are often very much engorged. Owing to the histological relationship between the blood-vessels and cells of the neoplasm, dissemination generally occurs through the blood-vessels. Nevertheless the neighboring lymphatics are by no means infrequently involved, and notably so in the case of sarcoma of the testis and sarcoma of the tonsil. If recurrence takes place after removal of the neoplasms, the secondary growth or growths are usually found in the internal organs. Sarcomata are not so painful as carcinomata, and the cachexia is not frequently present. When ulceration of the skin takes place from a sarcoma situated beneath, it is from pressure, not by infiltration. The edges of the ulcer are regular and round, or ovoid; the surrounding integument is healthy, and the sarcoma partially protrudes through the aperture, as a "fungus hæmatodes." The latter point is one of importance, for according to Gross' observations the presence or absence of a fungus hæmatodes would at once establish the diagnosis between sarcoma and carcinoma.

Histologically, the sarcomata are divided into the spindle-celled, round-celled, and giant-celled varieties, and since a medley of these cells may be found in any specimen, a fourth group, the mixed-celled sarcomata, is added.

Quite another form of sarcoma often met with is the cystic. The cystic sarcomata cannot, however, claim a special class, since they are merely ordinary sarcomata containing cysts which may develop by one of two methods, viz., (1) as a degeneration of the sarcomatous tissue, or (2) by the retention and increase of the normal product of the acini or tubules of the gland from which the sarcoma springs. The sarcomatous tissue may also bulge into the cysts (and even obliterate them), forming intra-cystic growths.

VARIETIES OF SARCOMA.

Round-celled.

Latin equivalent, cellas habens rotundas. French equivalent, à cellules arrondis. German equivalent, rundzelliges. Italian equivalent, a cellule rotunde.

Round-celled sarcomata consist essentially of round cells irregularly arranged in a homogeneous matrix. The vessels are generally mere clefts between the cells, and this intimate relationship is the explanation of the rapidity with which sarcoma disseminates through the blood-vessels. The round-cells are of two classes, large and small; the small round-celled variety naturally being the more malignant. The most common situations for this variety are the testis, tonsil, antrum of Highmore, and lymphatic glands (lympho-sarcoma).

Spindle-celled.

Latin equivalent, cellas habens fusiformes. French equivalent, à cellules fusiformes. German equivalent, spindelzelliges. Italian equivalent, a fusa.

The cells of this variety being spindle-shaped, some writers have concluded that they are really embryonic muscle and nerve-fibre cells in an arrested state of development.

As there are two kinds of round-celled sarcoma, viz., large and small, so also are there large and small spindle-celled sarcomata.

This variety is most common in the bones, testis, muscles, skin, and eye.

Giant-celled.

Latin equivalent, myeloides. French equivalent, à myéloplaques. German equivalent, Myeloidgeschwulst. Italian equivalent, mieloide.

The giant-celled or myeloid sarcomata are distinguished histologically by the presence of giant-cells, which are masses of protoplasm of considerable size, containing a very variable number of nuclei (from two or three to forty or more).

The term should only be applied to those tumors which contain a very large preponderance of giant-cells, among the other constituents—generally round or spindle cells, and not to sarcomata in which only a few exist.

Giant-celled sarcomata, therefore, occur nearly exclusively in the bones—and in the central portions of the bones. These neoplasms are most frequent in the lower maxillary bone, inferior extremity of the femur, and the head of the tibia. The giant-cells themselves are said to be distinguishable from those of scrofula, inasmuch as in those of this affection the nuclei are arranged around the periphery of the cells, while in sarcomatous giant-cells the nuclei are aggregated in the centre of the cells. But this distinction is a most equivocal one.

The giant-cells impart to the sarcoma a red or maroon color, like the red marrow of bones—whence the name, myeloid. Myeloid sarcoma is of slow growth; it disseminates slowly or hardly at all, and is said not to affect the lymphatic system. On these grounds it is recommended by some surgeons, in treating this disease, merely to enucleate the new growth, and not to amputate or to excise the bone with which the neoplasm is connected. (As a rule, however, I should advise amputation.—C. E. J.)

Sub-variety—Epulis, in part.

Latin equivalent, epulis, partim. French equivalent, epulide, en partie. German equivalent, Epulis, zum Theil. Italian equivalent, epulis, in parte.

Some of the forms of epulis (ἐπί, *upon;* οὖλα, *the gums*) are sarcomatous; and, if so, the bulk of their sarcomatous elements are very often giant-cells with a small proportion of round and spindle cells. Such neoplasms usually spring from the outer surface of the alveolar process, close to the teeth.

The upper jaw is more generally affected than the lower. The neoplasm is more or less connected with the periodontal membrane. It may spring from the interior of an empty socket; and is often caused by the irritation of the stump of a tooth. Nevertheless, epulis may occur where the teeth are in good condition, and, as it grows, displace or dislocate a particular tooth. In size, epulis varies from a pea to a walnut. The consistence of the growth is semi-elastic. Ulceration is uncommon. The tumor seems to spread in the direction of basal attachment rather than in height.

Local recurrence, after removal of the epulis, is very frequent, especially if the stump of the tooth associated with the growth be left behind. On this consideration, great care should be exercised in removal of neighboring stumps, and the growth excised, with the portion of bone from which it springs, very freely. Bleeding may be arrested with Pacquelin's thermo-cautery, or by the application of ferridized cotton.

Mixed-celled Sarcomata are merely those in which a combination of the forms of cells already described is found histologically, viz., round, spindle, and giant cells. The mixed-celled sarcomata attack the bones more often than other structures. (Some writers consider the mixed-celled sarcoma to consist only of round-cells and spindle-cells—whether large or small—to the exclusion of giant-cells.)

Melanotic.

Latin equivalent, melanoma. French equivalent, mélanome. German equivalent, melanom. Italian equivalent, melanoma.

The melanotic sarcomata are distinguished by the presence of black pigment, which may be found either within the individual cells or in the intercellular tissue. Melanoma, consequently, occurs in those regions where pigment exists; its most common habitat is the choroid, and not infrequently pigmentary deposit takes place in sarcoma of the skin.

Hemorrhagic.

Latin equivalent, hæmatoma. French equivalent, hématome. German equivalent, Hämatom. Italian equivalent, ematoma.

Some forms of blood-tumors are sarcomatous. The round and spindle cells can be detected, not only in the cyst wall of the tumor, but in the extravasation itself. This tumor is uncommon; it disseminates freely, and if recurrence follow removal, the secondary growth, like the first, presents a hemorrhagic character.

Lymphoma.

Latin equivalent, lymphoma. French equivalent, ganglíome. German equivalent, Lymphom. Italian equivalent, linfoma.

A lymphoma is a lymphatic-tissue tumor, and may therefore be (α) a tumor connected with the lymphatic vessels (lymphangeioma) or (β) with the lymphatic glands or adenoid tissue in the organs (lymphadenoma).

The lymphangeiomata, or tumors so-called, arising from lymphatic vessels are exceedingly rare, if indeed they ever exist. In elephantiasis Arabum, the connective tissue is associated with a dilatation and hyperplasia of the lymphatic vessels and spaces, but this is not a neoplasm, and should not be confounded with it.

Again, a lymphadenoma is a lymphatic-glandular tumor, but is often erroneously described as synonymous with the adenoid hyperplasia, such as acute, subacute, or chronic adenitis, caused by inflammation sequent to injury, to local irritation, such as pediculi, or to specific infection, as the syphilitic virus.

Further, by many writers lymphadenoma is regarded as synonymous with lympho-sarcoma; but lympho-sarcoma is the malignant variety of the lymphatic-glandular neoplasms, the other forms of these tumors being (1) the scrofulous, strumous, or tubercular neoplasm; (2) Hodgkins' disease, which consists essentially in a gradual enlargement of a cluster of lymphatic glands, with the subsequent implication of other groups throughout the body, and is in fact by some—Southam, to wit[6]—regarded "as a very generalized form of lympho-sarcoma." On the other hand, Hodgkins' disease is very closely correlated with leukæmia or leucocythemia, but differs from it "in the fact that the white corpuscles of the blood are not notably increased in number."[7]

A LYMPHO-SARCOMA, then, may be either secondary or pri-

mary in origin. If secondary, the neoplasm is clearly sequent to malignant disease of parts on the distal side of the lymphatic gland or glands affected. If primary, the diagnosis will be the more difficult, and must be arrived at by an elimination of the other varieties of the lymphadenomata, lymphatic hyperplasiæ or neoplasms simulating these conditions from locality, and by the positive signs and symptoms—already given—which serve to distinguish sarcomatous growths.

A lympho-sarcoma is histologically a small round-celled sarcoma, which simulates closely the appearance of a lymphatic gland. The matrix is almost hidden by the round cells, but if sections of the growth be agitated in a test-tube partly filled with water, many of the round cells are shaken out, and a reticulated stroma formed by the union of the branches of connective-tissue cells becomes visible.

Lympho-sarcoma usually invades the lymphatic glands, but often also the adenoid tissue of the mucous membranes. The tendency of the neoplasm to generalize is marked—in short, this tumor is exceedingly malignant.

Glioma.

Latin equivalent, glioma. French equivalent, gliome. German equivalent, Gliom. Italian equivalent, glioma.

A glioma is a tumor which springs from the connective tissue of the retina, optic nerve, brain, and spinal cord. It consists, histologically, of small round cells imbedded in a matrix, very much resembling a lympho-sarcoma. In the brain, a glioma may be found of size ranging from a pea to half that of one of the hemispheres. The color of the neoplasm (as seen on section) may vary from a pale pink to maroon. Yellow caseous patches, indicative of retrogressive changes, are not uncommon. Hemorrhage into the substance of the growth is also sometimes found, and a case is recorded by Dr. Gowers where, upon post-mortem examination, such a specimen was mistaken for a cerebral hemorrhage with adjacent softening. Modern surgery teaches us that treatment of these tumors is often not beyond our art. Gliomata of the spinal cord are exceedingly rare; they have no special histological features.

Retinal glioma is a disease of the newly-born and of children—a point of importance from a diagnostic view, since sar-

coma of the retina or choroid is rare, save in adults. The tumor may be solitary, or there may be one or two distinct growths at first, which may subsequently coalesce. In its early stage, it may grow either forward into the vitreous or backward into the choroid. The tension of the globe is first diminished, but soon increased.

Unfortunately the tumor is rarely detected at its commencement, since the failure of vision consequent upon it is generally overlooked by the parents: first, because the child is usually too young to read; and, secondly, because blindness in one eye consequent on a small glioma would hardly be detected by the laity, the other eye being intact. However, when the neoplasm reaches a certain magnitude, a bright, abnormal reflex is noticeable through the pupil. The pupil is usually dilated, and the anterior chamber is abnormally shallow. The globe becomes distended and painful; the cornea sloughs, and the growth protrudes through the lids. Simultaneously, the tumor may grow inside the optic nerve, and thus pass directly through the optic foramen into the cranium; or it may perforate the sclerotic, posterior to the insertion of the recti muscles, and infect the orbital structures.

Ophthalmoscopically, the diagnosis can generally be established with tolerable certainty; the absence of pigment is of importance as (usually) serving to distinguish this tumor from sarcoma of the choroid. It is not uncommon for both retinæ to be affected with gliomata. Secondary growths are not infrequent in the diplöe, and should the child survive sufficiently long, neoplasms of character histologically similar to the primary growths may be found in the internal viscera, especially the liver. If the disease be treated promptly, while in its earliest stage, by extirpation of the eyeball, the prognosis is hopeful; otherwise it is hopeless.

Psammoma; *syn.* Brain-sand Tumor.

Latin equivalent, psammoma. French equivalent, psammome. German equivalent, Psammom, *syn.* Sandgeschwulst. Italian equivalent, psammoma.

Psammomata, or brain-sand tumors, are varieties of sarcomata. Dr. Collins[8] exhibited a very interesting specimen before the Pathological Society of Dublin. The tumor had

been removed from an elderly subject in the Anatomical School. It sprang from the inner endothelial surface of the falx cerebri, near the crista galli. It projected into the subdural cavity, and had hollowed out a slight depression upon the overlying convolutions of the left frontal lobe of the cerebrum. Of soft consistence, it was easily separable from its attachments, about the size of a walnut and of a grayish-white color. Microscopically, it proved to be a "psammoma," or "angiolithic sarcoma." A fibrous investment and a fibrous stroma comprised the chief bulk of the tumor. Imbedded in it were very minute isolated calcareous particles of brain-sand, reflecting light and presenting their peculiar concentric lamellar arrangement when examined under a high microscopic power.

These were chiefly remarkable for their very small size, and scanty distribution throughout the fibrous elements of the tumor. The tumor was exceedingly vascular. Some of the sand particles were very near the walls of the vessels, but no such definite connection with them could be ascertained as led Ranvier to believe that they were deposited in ampullary dilatations of the walls of the vessels from which they subsequently became detached. No cells were found differing from those proper to sarcoma, so as to favor the epithelial mode of development, as suggested by Meyer and Robin; but in some instances the concentric arrangement of the spindle cells described by Steudener was observed. Virchow's view, that such tumors were hyperplastic growths, owing their origin to increased development of sand-formations which are so often found on the inner surface of the dura mater and in connection with the choroid plexuses, seemed to Dr. Collins the most correct as regarded the specimens he exhibited.

CHAPTER III.

CANCER IS A LOCAL DISEASE.

CANCER is a local disease, and as it is evident that the principles for the rational treatment of cancer must depend upon whether or no the balance of evidence is in favor of or against the local as distinguished from the "constitutional" theory of cancer, this question is practically the most important in connection with the whole subject.

At the present day, all the various methods of treating cancer may be grouped under two main headings:

1. Methods which have for their object the removal of the growth or growths from the body by amputation, excision, or destruction by cautery or caustics.

2. Attempts to procure resolution of the disease by medicaments administered internally in order to purify the blood; methods for palliative treatment, all hope of eradicating the disease being abandoned; various "cancer cures" and patent nostrums, etc.

I say cancer is a local disease, chiefly because I know that it generally originates locally in some peripheral part of the body, and spreads through the lymphatics or blood toward the central organs; and therefore, with certain reservations, it must be treated early and boldly upon the lines laid down under heading 1.

Some practitioners say cancer is a "constitutional" disease, because they believe its "germs" lie dormant in blood, "constitution," or central part of the body, suddenly appearing, in a visible and tangible form, locally, and therefore to be generally treated according to the lines laid down under heading 2.

Thus stated, the issue is plain enough—cancer is either local or "constitutional," and must be treated upon one of two opposite lines; and, of course, the known effects or results which have been obtained by various methods of treatment must be

considered as relevant to the point in issue, because they may be considered as tests, in some measure, for or against the local or constitutional theory.

But fortunately or unfortunately, as the case may be, in medicine we may think what we like, and usually express our professional opinions with impunity; and some of us contend that cancer is partly a constitutional disease and partly a local one. If Sir James Paget, who belongs to the third party, would define what he means by the terms "cancer," "local," "constitutional," "heredity," and precisely state how much of cancer is local and how much constitutional, the difficulty which arises might be overcome; but the limits of practical discussion having been transgressed, others step in and say (though not quite in so many words), "I am Dr. A., and I think cancer almost a local disease, but dependent," etc., and so on with all kinds of qualifications. The debate proceeds, and the apple of discontent was thrown down at the Pathological Society in 1874, when the late Mr. Campbell de Morgan read a paper entitled "Observations on Cancer: its Pathology and its Relations to the Organism, and to other Morbid Growths."

Now, inasmuch as this very valuable contribution and the discussion thereon lasted four evenings, and the speeches of the very eminent men who took part in the proceedings are recorded, and can be carefully studied to the advantage of any one who wishes to find a condensed representation of the much-divided opinion of the medical profession on cancer, a useful purpose has been fulfilled by the Pathological Society. But as most of the speakers, for lack of proper definition, understood in a more or less different sense from his neighbor the principal technical terms which were imported into the speeches, I could not, as I read them, refrain from thinking of the time-honored lines:

> "Persuade a man against his will,
> He's of the same opinion still."

Nevertheless, from this debate upon cancer can be culled a good deal of information bearing upon the local and constitutional theories. Mr. de Morgan, however, instead of putting this issue plainly before the meeting, wrote as follows:

"The views which have been entertained as to the origin of cancer are various. We may, I think, embrace them under the following heads:

"1. That a cancer tumor is the expression of a specific blood-condition; standing in the relation to this blood-condition of a secretion to its gland.

"2. That a morbid material is present in the blood, which, coming into relation with an appropriate tissue, enters into combination with and causes the growth of the tumor.

"3. That the disease has its origin in the constitution at large, the tumor being only the local manifestation.

"4. That the disease is in its origin purely local.

"5. That, though local in development, there are general or constitutional conditions favoring its occurrence."

This author also proceeds to say:

"I have mentioned hereditariness as one of the grounds for regarding cancer as not a mere local disease. I believe cancer is more frequently inherited than is generally admitted. We find the proofs of inheritance quite often enough to allow us to reckon this as one of its factors. In a large number of cases, moreover, in which no proof can be found of the existence of the disease in a progenitor, we can trace it in collaterals; and it seems to me reasonable to conclude that in such instances, though the common parent may not have lived long enough to develop the disease, it was present potentially. Now, it is contrary to reason to conclude that the constitutional disposition, whatever that may be, is often present without the disease becoming developed. This must be the case where a disease or peculiarity has skipped one or more generations. The peculiarity of the grandfather may reappear in the grandson, though the father may not show it; yet the father must have something in him which he can transmit, though it never be seen in himself. . . .

"Before giving my reasons for attributing a local origin to cancer, it may be well to state the difficulties which lie in the way of my reception of the blood hypothesis. These are: 1. That all the facts in the history of a cancer can be explained without resorting to it. 2. That there are some facts which militate against it. 3. That, if we receive it, we must admit either that the same blood-poison aids in the formation of simple tumors, or that each tumor has its own especial poison. . . .

"There is nothing which seems to contra-indicate the presence of a blood-poison in cancer more than the well-known

fact that the disease, after operation, rarely returns in any of the ordinary seats of election. Scirrhus of the breast, for example, while it returns constantly in the skin, in the connective tissue, in the lymphatic glands, and in muscle, seldom returns in the opposite breast. This is as true of cases in which there has been a long immunity after operation as in those in which the disease returns rapidly. Were the disease seated in the blood, should we not probably find recurrence in those organs which we recognize as the ordinary seats of primary cancer? The same remark applies to medullary cancer of the testicle, to epithelium of the lip or tongue, and to diseases of symmetrical parts generally. Surely, as more than half of all external cancers are seated in the breast, we should expect to find the second breast more frequently the seat of disease if the blood-condition were a determining cause. . . .

"As we shall see, the mere structural peculiarities will explain the differences in the degree of malignancy found in the various forms of cancerous and other tumors. In most cases the first notice we have is the appearance of a tumor, and in those of internal cancers or other allied tumors the new growths may have attained a large size, and have spread and infected many other parts before any sign is shown of their existence. This is widely different from what we see in blood-diseases generally, in which some symptoms, inflammatory or other, precede or immediately follow the outbreak of local disorder. But what symptoms of cancer in its early stages can we find beyond those afforded by the mere existence of the tumor itself? Is it not rather the case that our suspicions are aroused by the very insidiousness of the local disease? There are some things, indeed, which do make us suspicious of a cancerous future; but they are purely local conditions, and may exist for years before any real malignant disease shows itself: when, for example, with cancerous antecedents we find an undeveloped testicle, or a breast which is unable to perform its functions, or when the skin is the seat of brown scales or moles, which as we advance in life become larger or perhaps irritable, or when the tongue is ichthyotic. So, too, we shall see without surprise a cancer grow where the lip has been long irritated by the pipe, or the tongue by a ragged tooth, or the scrotum by soot. In regard to this latter source of irritation a curious question arises. Chimney-sweeps' cancer used to be

a very frequent disease. The disuse of climbing and the cleanlier habits of the sweeps have greatly diminished the number of such cases. If, then, epithelioma be a blood-disease at all, the probability is, the number of cancerous persons remaining the same, that if the local seat be not found so often in the scrotum, it must be established elsewhere. Consequently we ought to find an increase in the frequency of cancer in other situations."

Mr. Jonathan Hutchinson's remarks, which were strongly in favor of the local origin of cancer, were substantially as follows:

"Some fourteen or fifteen years ago I read a paper before the Hunterian Society on a similar subject, contending for the local origin of cancer, and I have ever since that time taught this doctrine to the students with whom I have come in contact as earnestly as I could, because I think that in the belief in the local origin of cancer rests our only hope of dealing satisfactorily with it as surgeons. I also believe that our patients' interests are prejudiced most seriously by the sort of hesitancy in the belief of this doctrine by a large section of the profession. It must have happened, sir, to you and to all members of this society very frequently indeed, to see cases which, if treated on the theory of the local origin of cancer, at an early stage, might have been satisfactorily cured, but which, having been neglected, have been allowed to get possession of the body, to infect the blood, to infect the glands; and a disease which was curable in the early stage has become in the end totally incurable. . . . We still have a very considerable number which we can attack most satisfactorily if we believe that it begins as a local disease. Now, in contending that cancer is for all practical purposes a local disease, and that it is very important for surgeons to believe that it is such, I by no means wish to put aside the argument of those who say that it is also constitutional. I think Mr. de Morgan hit the point very exactly. So far as I understood his argument, it was that cancer is a blood-disease. To use the expression 'a blood-disease' is to mislead us. I was glad to hear the remark that fell from Mr. Simon to the effect that those who in former years, perhaps somewhat erroneously, used this expression, had done so without any intention of excluding the solid elements of the body. No doubt it is, so far as it is constitu-

tional, a disease of the solid tissues and not of the blood. I think the sooner we get rid of the expression 'blood-disease,' and use the term 'constitutional,' or 'disease of tissues,' the sooner we shall get to clear ideas on the subject. . . . To return, then, to Mr. Simon's question, whether we are to say that cancer is specific or not, I confess I do not attach so much importance to it as Mr. Simon appeared to do; because, after all, specificity is a relation. If I say a thing is specific, I mean that it is specific in relation to something else, and I have to define what each of these things is from which I say it specifically differs. There is no doubt that cancer has peculiarities; otherwise we should not need to have any name for it. There is no doubt, again, that almost all the morbid processes in the human body have a relationship, and what we have to define is rather the degree of relationship which they have to each other than to contend that this and that are so absolutely distinct that we are to say that this is one species and that is another species. We must define species before, as it seems to me, we shall gain any practical good by arguing whether cancer is a particular species or not. A separate species from what? Because it enters, I think, by degrees which it is very difficult to distinguish, into relationship with several other diseases which have been already alluded to this evening.

"Illustrating its relationship, I would mention one which I think Mr. de Morgan has not alluded to—that is, the occasional transmutation in hereditary transmission. And this is a line of argument which I think may be applied in elucidation of many other diseases besides cancer. I think we might prove conclusively the essential relationship of different diseases, or diseases which have different names, by observing whether in hereditary transmission you get them transmitted. Say you get rheumatic gout transmitted into gout, or in the transmission of gout you get rheumatic gout as the product: then I hold that these two things stand in very close relationship to each other. . . . Then I wish to ask, as a matter of purely clinical fact, whether we do not sometimes observe in the hereditary transmission of a cancerous tendency transmutation, and whether we do not in that fact of transmutation get a proof of relationship. I allude especially to the distinction between innocent tumors and malignant tumors. I rather put the question to those who have more experience on that

point than myself—whether it is not tolerably common to notice this. I believe the most definite instance of it is in respect to common warts. It has chanced that I have had some remarkable instances myself. I believe that patients who are liable to common warts in unusual numbers will generally be found to have relations who have suffered from cancer. I believe this is an observation which came from that home of observation in reference to cancer—the Middlesex Hospital. Mr. de Morgan will correct me if I am wrong. I think it has been noticed there—and I can confirm it—that in several remarkable cases in which patients were covered from head to foot with warts, there were near blood-relations who had been suffering from cancer. And there has certainly been observed in hereditary transmission the same proof of relationship between the various forms of innocent growths and those strictly malignant. Then, as regards hereditary transmission, there is another interesting series of facts which should be carefully collected, as to what beomes of the children of parents who were cancerous at the period of birth or conception. I think we might easily collect a considerable number of instances of that kind, and I feel sure that we might get some interesting facts from them. It has happened to me to investigate these facts, in several cases in which very young children became the subject of cancer of the testis I recollect especially one young lad, remarkably healthy and well grown, who, at the age of eighteen months, became the subject of cancer of the testis. In his case there was a most definite history of cancer in near relatives. In several other instances I have seen the same thing. Then I think it should be observed also that the kind of cancer is often changed, that the mother who has suffered from cancer of the breast has a child who perhaps suffers from one of the various forms of cancerous action which attack different tissues of the eye. In passing, let me remark that I suppose we have come pretty much to the conclusion that the differences in cancers and malignant tumors depend on the tissues which the cancerous action commences in. The cancerous action, if we may be permitted to use such a term, is pretty much one and the same, and the differences depend upon the cell-tissue in which that action begins. I say I think we very often see a transmutation in hereditary transmission. That which was scirrhus in the mother becomes, perhaps, soft cancer in the child. . . .

"I cannot help again thanking Mr. de Morgan for his very able paper, and for directing the attention of the profession to a most important point. I headed a short article that I wrote ten years ago, in the London Hospital Reports, 'The Successful Cultivation of Cancer,' and I recollect giving precise directions to those who wished to let their cases pass into cancer, how they should do it: how they should neglect a little ulcer, and let the patient go on, saying that he had nothing but a little wart on the lip; how they should let him go on smoking, and so cultivate cancer; or tell a man with a little nodule on his eyelid to put a little cream on, and that it was of no consequence, and that he might pick it from time to time, so that, trusting to the local origin of cancer, he might breed for himself some of the most malignant forms of the disease. My reason for adopting that title and using the style I did was my anxiety to direct the attention of students of the profession to the practical importance of acknowledging the local origin of a great number of forms of cancer, and the importance of very early treatment, if we wished to secure our patients against becoming constitutionally affected."

Afterward Sir James Paget followed, who, in the course of an exceedingly lengthy speech, considered "that we must hold both a local and a constitutional element as a necessary condition in every or nearly every case of cancer that comes under our observation;" and he endeavored to support his contention by excluding rodent ulcer from the category of cancer, by adducing reasons to support his view that cancer is hereditary, and by alleging that cancerous growths—notably those of the breast—recur in 499 cases out of 500 after complete excision, and by other more than doubtful assertions. Now, with all due deference to Sir James Paget's wide experience, I venture to think that he has gravely exaggerated the facts when he says that cancer recurs 499 times out of 500, though, of course, that may have been so with reference to patients which have fallen under his own care or observation, in which case the results have been deplorable.

While admitting freely that cancerous disease returns in a considerable number of patients after operation, I would ask Sir James Paget what he means by "complete excision"? If he believes that in the bulk of cases operated upon (even in the metropolitan hospitals) the cancerous growths have been completely removed, I am afraid he is mistaken.

Sir James's remarks were made in 1874, and although in the present year (1889) a very considerable advance has been made throughout the profession as regards improvements in operative surgery, and the almost universal adoption of the antiseptic technique—by which means the general mortality consequent upon capital operations has been enormously reduced, besides a more enlightened view on the part of the public as to the necessity of undergoing operations when recommended by competent authority—yet I would undertake to say that of all the operations performed in the United Kingdom during the past year, which professedly had for their object the complete extirpation of cancerous disease, in more than half such cases particles of the growth were left behind. Under these circumstances I am never surprised to hear that patients operated upon successfully(!) for cancer have, within a few months, become the subjects of recurrence either in the scars or adjoining lymphatic glands.

Unfortunately there are different meanings which may be applied to the term "heredity," and Sir James Paget has ingenuously adopted one under whose mantle cancer can be considered hereditary; and then, by a little verbal alteration, the term "hereditary" merges into the term "constitutional," and the constitutional theory is proved!

Sir James says cancer is hereditary, because he "can without difficulty count, as actual facts, not less than one in three of all patients with cancer in whose families the occurrence of cancer is well known." If this be a definition of heredity, I am afraid we must count almost every disease as such.

"But this number does not nearly represent what we may very safely assume to be the predominance of inheritance of cancer. A large number of persons die of internal cancer, and convey it to their offspring, though it is never known that themselves have been the subject of cancer, or at least never recorded."

I am prepared to admit that a good many people who have died of internal cancer are reported under the head of other diseases; but then it is equally true that an equal number who die of diseases other than cancer, have their deaths erroneously ascribed to that disease.

"About half of them passed from the progenitor to the offspring as cancers, and as affecting the same organ, but this is

a half which affects almost entirely the uterus and the breast, respecting the tendencies of which toward cancer I would speak hereafter; but on the other half, which is the more characteristic in this respect, there is no rule at all. The cancer of the breast in the parent is marked as cancer of the lip in the child; the cancer of the cheek in the parent becomes cancer of the bone in the child. . . .

"When a local disease is inherited it passes from progenitor to offspring in the same tissue, if not in the same place. A malformed finger may pass from parent to offspring, but a malformed finger does not generate a malformed heart or a malformed brain."

All will agree that a hereditary disease or condition is one which has been transmitted to the offspring from an ancestor; but it requires very careful watching to enable us to discriminate between the transmission of a particular condition or its coincidence in parent and offspring; and the matter is further complicated when we consider that some conditions may appear in the offspring either by hereditary transmission or by introduction into the system from without.

Let me illustrate what I mean by examples: a supernumerary finger is a hereditary condition, because its appearance cannot be explained upon any other hypothesis than by transmission; the child is born with the supernumerary finger, which therefore must have been inherited. It is also purely local. Syphilis may be (1) either transmitted by inheritance or (2) introduced into the system from without *de novo*.

But as syphilis may originate *de novo* in the offspring, it may also originate by coincidence in both parent and offspring, in each case by introduction from without, and by coincidence the disease may occur in the child at a date prior to its occurrence in the progenitor.

With regard to syphilis, we know very well how to decide the source of infection in cases which come before us; but if we consider how we do so, some light may be thrown upon the question of the hereditary transmission of cancer by striking a parallel.

When syphilis is transmitted the congenital form is of a type peculiar to the ancestral form, and presents fixed and definite characteristics.

Assuming cancer to be hereditary, it ought therefore, by

its transmission, either to acquire a certain definite type, as in syphilis, or else invariably to reappear as a fac-simile of the parent disease; but Sir James Paget admits that it is only in about half the cases of what he considers instances of hereditary transmission that the same variety of cancer appears in a corresponding site in the offspring, and those cases happen to be principally of the breast and uterus—Sir James omitting to qualify his arguments by drawing attention to the large numerical preponderance of cancer as occurring in these organs, and that therefore the appearance in parent and offspring can be explained upon the ground of coincidence better than on that of transmission.

I say cancer is not hereditary, first, because when it occurs in families, such occurrence is only in one-third, one-tenth, or fewer instances, according to different authorities; secondly, that coincidence in the case of a common disease, such as cancer, is sufficient to explain such occurrences; and, thirdly that the supposed transmission of cancer directly from parent to offspring, of a particular variety supposed to be transmitted to a particular site, has been improperly based upon a consideration of the commonest varieties of this common disease. As to the possibility of inheriting a predisposition toward the development of cancer, we are now entering a very nebulous atmosphere. Perhaps such a thing exists, perhaps not: speculation on both sides can be carried to great lengths. But we must not forget—since a suitable soil is necessary for the plant-like growth of cancer, and since some soils (individuals) are more congenial to its growth than others—that the favor able nature of the soil, or the reverse, may be transmitted by inheritance. All diseases are governed by pathological laws, some of which we can define and of others we are ignorant. Again, pathological laws are frequently correlated with physiological laws.

There is a pathological law by which epithelial cells may proliferate and invade contiguous structures, giving rise to the disease we call cancer.

There is a physiological law by which certain cells of epiblastic origin which form the germ-epithelium of the ovary actually invade the substance of that organ, which consists of mesoblastic tissue; but the invasion is not progressive, the epithelial cells again rising to the surface and becoming the

future ova. Still these two conditions, one physiological, the other pathological, are identical, so far as our present means of investigation enable us to judge, up to a certain point.

Sir William Gull and the late Dr. Moxon, among others, held views opposed to Sir James Paget on the nature of cancer, and as the reasons for their views appear to me to be more clearly expressed than those of many other speakers who took part in the debate at the Pathological Society, I will quote their speeches in full as they appeared in the "Lancet:"

"SIR WILLIAM GULL: I only wish, sir, that I had Sir James Paget's power of exposition; because if I had, I think I should be able largely to demolish the charming structure which he has set before us of the constitutional origin of cancer. If you consider for a moment and analyze the word 'constitution,' you will find that it has two very different meanings —a meaning with which we all agree and a meaning with which we disagree. I take it that when Sir James Paget contends for the constitutional origin of syphilis from its hereditary tendency, he must refer to some condition of the ovum or spermatic fluid, or the two together, which, whether conceivable or inconceivable, exists. If we carry our minds to the very beginning of the impregnated ovum, and say that the mother or the father is to convey to this ovum a cancerous tendency, that must lie outside the blood anyhow, for there is no blood then and there; therefore the constitutional question must have relation to the constituents of the ovum at that time. Now, if we consider how this ovum develops, how (to use the technical expression, which really has no sort of meaning) it 'differentiates' into the various organs of the body—that is, that they form somehow or other—then, I take it, we must at last trace this constitutional condition to a local seat. The ovum has differentiated into the various textures of the body, and has been exhausted, if I may so say, in the formation of the organs. I think we are bound to admit that where the parents on one side or on the other have had cancer, it is apt to appear in the offspring; yet we are bound by the laws of all scientific inquiry to believe in localization somewhere. As the lawyers say, *latet dolus in generalibus.* Here, I think, is the mistake. We have got hold of a general expres-

sion in the word 'constitution' which was true enough in the ovum, but ceases to be true in the adult, because there we can realize the conditions of localization, and there we find that the ovum has differentiated into the various tissues of the body. And if there is one physical fact in the history of cancer more distinct than another, it is this—that certain of the organs are much more liable to it than others, whether it be the female breast or the os uteri. Admitting all that can be said about the constitutional origin, there are undoubtedly local seats of cancer. I challenge the constitutional theorists to tell me why it should not appear in any particular part of the intestinal tract, which it especially and particularly affects. There are certain points which we know it will affect—say the end of the œsophagus, the pyloric end of the stomach, the duodenum; then we get over twenty feet of intestine which it does not affect except secondarily, though it is equally vascular. There are very few primary cancerous ulcers of the jejunum; they now and then occur, but so rarely, Sir James Paget puts them at one in five hundred, and perhaps they are rather more rare than that. . . . Then we come to the lower end of the ileum, then to the cæcum, then to the sigmoid flexure. Sir Benjamin Brodie said that when you had cancerous disease of the colon it was never higher than the sigmoid flexure. I suppose he meant escaping the cæcum. The great fact still remains that cancer does show a predisposition to appear in special parts of the body. Therefore, while I fully admit the constitutional predisposition, I can only admit it when I have to do with an undifferentiated ovum. So soon as the ovum is differentiated into tissue, then I say that what is called a constitutional condition becomes a local one. I cannot but think that if we could investigate the first beginning of cancerous change, and could take away the part, we should for the time rid our patient of the cancerous tendency in the particular part or place. My own belief is that when you talk of blood-disease you are lost in conjecture; and when you begin to explain blood-disease by reference to such a disease as gout, you are still more lost in conjecture. For there is no proof whatever, as far as I know, that gout is a blood-disease; nor, indeed, that typhoid fever is a blood-disease. The blood may be a channel of disease, whereby certain poisons may affect the texture; but (as I used to say when I lectured on medicine) assuming, if it were

possible, a man to be all blood, he would not have typhoid fever and he would not have gout. It is the textures which lie outside his blood that are the seat of those conditions which we call gout and typhoid fever. The blood is a very indifferent fluid; it has elements which are not indifferent, viz., the red and white cells, but quasi-blood is a singularly indifferent fluid; it has to be differentiated into a certain condition of tissue before it can assume and present the morbid phenomena of disease. Therefore, although I am not in the least able to supply all the steps of the reasoning, or adduce all the facts by which perhaps my mind would be influenced, I cannot but think that the question of constitution requires reconsideration, and that even syphilis as a constitutional disease may very much be reconsidered. Take the case of hydrophobia. I once saw a man (and the practice of medicine supplies us with many such instances) who was bitten by a dog, and it was thirteen years before he died of hydrophobia. Where did that poison lie? Not in his constitution, I take it—if you mean by constitution floating about anywhere and everywhere. I think it lay in the tissue that was bitten—that the poison lay there latent, producing but little effect till a certain time when some changes (this is hypothetical) came over the tissue and infected the man, and he died of the disease within thirty-six hours. I think it must have been lying in his tissues. Therefore I think, in dealing with malignant disease, as I have dealt with it practically, you must regard it as a local condition of the tissue then and there, however much the local development of it may have had to do with some inherited predisposition, which you may properly term constitutional.

"I do not, therefore, quite partake of those feelings of hope expressed by Sir James Paget, that we may succeed in finding some remedy which shall just have the same effect on cancer as that which has been produced on syphilis. It may be so or it may not. With regard to the change that takes place, we have been told that it is a cell-change. Well, perhaps it is not a cell-change; perhaps it is the fluid outside the cells. Who knows? A cell is an organism of enormous extent; it is only our eyes being so feeble that makes us look upon it as a small indifferent thing. It may be infinitely more delicate than those great things which we see under the microscope, even though it be the fiftieth of an inch in diameter. I

was therefore a little surprised at my friend Sir James Paget when he referred to osteoid and scirrhous tumors, thinking that their hardness might be a kind of obstacle to their infecting the body so readily. Oh! those fluids, those queer things, those endosmoses and exosmoses, may act in places and parts that we know nothing about. Besides which, it is not unimportant, as Mr. Arnott has said, that it depends very much upon the place in which the tumors are situated. There are so many accidental positions. It is notorious that affections of the bone, where the veins are so large and where there is a peculiar condition of the vein, are very prone to spread. We know that abscess in bone is constantly attended by secondary abscesses over the body, so that hardness alone would not do. We must regard the accidental conditions of the situation of the part. If a man comes to us with a great lump in his side, we are obliged to tell him that we believe it is malignant disease. Of course he can only come when he gets it of sufficient magnitude for it to be palpable or for some suffering. We can make no diagnosis before, and if we could we could not touch it. Therefore the practical treatment of cancer by local operation must only refer to parts outside. In the Clinical Society I once said that if I were to become the victim of cancer I hoped it would be in my retina; and I have the same feeling still (though the case I spoke of was, as my friend Dr. Murchison has shown, one of spindle-celled sarcoma), because I should soon observe the defective vision, the eye would be quickly extracted, and I think I should have a long immunity from the disease. Certainly clinical medicine shows that cases of operation on the eye have a longer immunity from secondary cancer than cases of operation elsewhere. I think that is a highly suggestive fact."

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"Dr. Moxon: The course of the debate hitherto, sir, has been rather surprising to me because of the sweet and pleasant general agreement that one has found pervading the atmosphere. I could only compare it, not certainly to opponents bringing forward in any form opposite views, but rather to rival painters representing the same scene, one pointing to one part and saying, 'This is preferable,' and another indicating another corner and saying, 'Nay, direct your eyes here.' But it is not with that impression I approached the subject of can-

cer. To my mind there was something to discuss, especially as to the origin of cancer. It is true, when Mr. de Morgan brought forward his very eloquent paper he did embrace views in a sort of Pantheon, if I may so speak, almost disregarding their natural oppositions and incompatibilities. I was scarcely prepared to find all the subsequent speakers equally bringing forward the opposite sides of the question, as though they could lie down together. It may be crudeness and incapacity on my part to perceive the ways in which opinions may shade into each other and become identical, however opposed, as red and blue are naturally; but to me it has always appeared that the local and the general view—localism and generalism—are essentially opposite, that they are not compatible, and cannot be held by the same person at the same time. As I understand the question, it may be put this way: Does the first cancer that appears in the patient's body generate the cancers which appear afterward? does it precede them in every way? or, on the other hand, is there a general state of the whole system which is ready to put out cancers anywhere, and puts out the first in the same way as it puts out the second or third? It seems to me that no one can hold those two views at the same time; one of them excludes the other. But then it might be that that opposition, although sharply definable, is nevertheless unimportant. Surely, sir, we cannot conceive that. It must be that that is the division under which all practical surgical differences must range themselves. If a cancer arises as a little patch in a person previously healthy, and then expands itself throughout the frame, so that, poisoned by that one spot, the life of the patient soon becomes hopeless through the effects of that spot upon remote parts, then surely the surgeon will have recourse to the knife, and as quickly as possible remove the first spot that appears. And if, as Sir James Paget says, after removing 500 he finds 499 recur, then he says, 'Let me remove it earlier.' He would even, as the Israelites of old, have published abroad the first sign of such a scourge, that people might from the very first moment of its appearance come forward and let the surgeon perform. On that view I can quite understand Mr. Jonathan Hutchinson's strong speech. He seems to me to be the only pure localist who has as yet given us his opinions; and in his readiness to come forward he spoke like a good surgeon. If

I remember rightly, he argued in favor of his view because it would lead us to operate, as though pathological faith without works is dead. Taking the other view, and supposing that the general system is first charged with cancer, and that all the cancers that appear are but outputs of this general cancerous store, why should we operate at all? Should we not rather leave what exists alone, lest by removing it we should bring about a worse evil? That surely is the great question that we are here to discuss; and the distinction between those views is absolute, and it cannot be bridged over. You must either take one side or other of the question, or you must drop it altogether. But unfortunately there is another road, and you are not obliged to drop it altogether. You may adopt some doubtful, ambiguous word, and cover with that word the essential difference that there is between those two views; and a word has been brought in which has largely played that part in the discussion—that is the word 'constitutional.' I heard in all the speeches the word constitutional used as if it were the opposite to local. Now, sir, I must protest with all my power against such a use of the word. It has been gravely argued here that if, when any person is subjected to a common kind of injury, his tissues react in an unusual way he must have a constitutional peculiarity. That argument is either a truism or a fallacy. If by it you mean that a part subjected to an ordinary injury, if it acts peculiarly, must be peculiar, that is a truism. But if you therefore conclude that the whole frame would, under similar circumstances, act in the same way, then your conclusion is a fallacy. There is no opposition whatever between constitutional and local. What, for instance, can be more constitutional than one's great toe or one's liver? What is constitution but (as I understood Sir William Gull to put it) the putting out in different localities things which were enfolded in the germ? So that really to become local is the very essence of being constitutional. I would even say that nothing is constitutional that is not local. But without dwelling upon that, let me say that I am only objecting to the use of the term constitutional, which, I conceive, must haze into limbo the whole question while we continue to use it in that ambiguous sense. But there is a good question before us, and that is this. Drop the word constitutional altogether; recognize that cancer is a disease which

ultimately kills by becoming general, and which at first is local; and then the question is, Does the general condition precede and cause the local, or does the local condition precede and cause the general? Both of these views cannot be true; and the word constitutional, in its vague double meaning, had better be dropped out of the question altogether. That, I say, is a good question, because it is a realizable and soluble question; and although we may not be able to solve it now, yet I hope that the good and proper work of this society—the bringing forward of items of fact which shall lead up to some conclusions—may tend in that direction, so that in time this soluble question may be solved. At present the mode in which the question is treated I will describe in this way. Some hold to the local view and others to the general, never allowing it to appear (through a politeness or gentleness to each other's views) that there is any actual divergence between them. One takes up his position for the local view, another for the general view, and each tries to press the origination of cancer from his own point—the local or the general. So they resort to a competition who shall show the earliest appearance—whether the localist shall show the earliest appearance in the spot, or whether the generalist shall show that cancer appears earliest in the whole frame. Now, I believe that cancer appears earliest in a certain locality—that cancer becomes general and fatal through the influence of a part first cancerous. In other words, I am strictly a localist. I will, therefore, very shortly place before the society those arguments or those facts and bearings which I think are capable of supporting that view. No one can be cognizant of the interesting facts that have been from time to time brought forward in this room without following one easily through these propositions: First, that cancer spreads in the part (we are not likely to forget that); secondly, that cancer runs along the lymphatics to the glands; thirdly, that cancer makes its way along the blood-vessels to organs remote through the medium of the circulation. Those are facts which are certain; there is no hypothesis about them. Let that thought govern your ideas, and then what room is there for any notion that a general state of cancer precedes a process of the kind? If it is at all probable that cancers come in spots, run along the lymphatics, and go away to remote parts, where is the room for general carcinosis? I

will put it in this way. If any one conceiving himself to be a generalist allows me this, that whatever is pervading the general system, something must have happened in a part, and through that something which has so happened in a part, the general system is afterward affected—that is, the affected part and the subsequent results on the general system that cause and constitute carcinosis—then I say he is a localist, and however great he might be and however eloquent, I should claim him as such. I said that cancer extends in the part, runs along the lymphatics, and goes to remote organs in the circulation. But there is another kind of evidence, for which, if I had Sir James Paget's eloquence, I should certainly claim a very special kind and form of recognition from the members of the society. I should like them to approach it in a peculiarly receptive attitude of mind, because it wants some delicacy to feel all its exquisite bearings. Let me give this as an instance. A man gets a cancer in his rectum; you examine that cancer and you find it is a big one. He has got also cancers in his liver; you examine those cancers and you find they are little ones. The great cancer in the rectum is obviously prior in time to the minute development in the liver; the one certainly precedes the other. But when you come to examine the cancers, what do you find? You find that the rectum cancer is rectum tissue. I am sure I may appeal to the experience of many pathologists here, when I say that we do find cases of cancer in the colon and rectum whose structure is really that of the Lieberkühn follicles of the mucous membrane of the gut. Well, that would not have been wonderful if, when we went to the liver, we found that the cancer exploding in the liver had taken the shape of the liver tissue, just as when exploding in the rectum it had taken the shape of rectum tissue. The generalist, if he thinks that there is any general state of cancer which comes out locally according to the nature of the part, must expect to find rectum cancer in the rectum and liver cancer in the liver. I do not hesitate to say so, I have seen Lieberkühn follicles of exquisite construction in the liver itself. Lest any one should doubt me, and think that I am drawing on my own imagination, I will bring forward a very common instance. Ten months ago there was a man in Guy's Hospital under my care with a monster tumor in the arm, near the shoulder. The poor fellow went to the

bad and died. When we examined him we found in his lungs other small tumors. The bony tumor of his arm proved, on microscopic examination, to be osteoid chondroma, according to Virchow's nomenclature; the lumps in the lungs were bony too. There was a vast mass in the arm, and there were little bits in the lung. Obviously the arm-disease had preceded the lung-disease. And what had grown in the lung? Why, bone; and it was in bone that the disease commenced. If it were a general cancer pouring out cancer in the two parts, developing according to the part, we should have had lung in the lung and bone in the bone, instead of bone in both cases. Looking at these facts, how can the conclusion be resisted that it was in bone the cancer arose, and that the cancer must be interpreted in this way—that it was the acquisition on the part of the bone of a power of instilling its own nature upon the lung? I should like to use Mr. Simon's words; they are words that I have used for a long while. He spoke of a sort of spermatic influence, and the term is a very good one. It is more like generation than anything else. The bone became spermatic to the lung, so that it sent off its elements and colonized the lung with bone; and the lung became bone through a kind of spermatic influence from bone. I am putting it very hardly. I say, then, that another very powerful argument in favor of the local origin is this, that the first cancer that appears has a likeness of the part in which it appears; and the secondary cancers arising from the generalization have the likeness of that first cancer; and those who doubt that they come from the first cancer must show us why they have that likeness.

"Then there is another point which ought to be specifically, boldly, and clearly stated. I have here a little drawing which I made in 1866, to show that in the process of cancerous change a transformation of the individual cells is traceable. I mean that when, as in that instance, liver becomes cancerous, you can see a liver-cell turn into a cancer-cell. Of course you cannot watch the individual liver-cell. If we had the universal periscope, we might, no doubt, see what actually took place; but we are obliged instead to see a liver-cell as one perfect thing and a cancer-cell as another perfect thing, and then, to our mind's eye, to perceive the gradations between the liver-cell and the cancer-cell—gradations so exquisite that you cannot see where any break in nature occurs. That is surely a

strong argument. If you can find, as in that case, that the process extends from breast-cancer to the liver, and if you watch the change and see the cells changed as they stand, that is a strong argument in favor of the whole process being due to the influence of the original cancer. But what have we as opposed to this, which I think a very sufficient argument in proof of the local origin of cancer? For I would say that if those facts can be proved in reference to all cancer, then there is no room whatever for any suggestion of general carcinosis; it takes the wind out of its sails; it is not wanted. When you prove that from the first cancer all that we call cancerous change and cancerous generalization does arise, there is no room for any other hypothesis; you have occupied the field, and whoever comes with another hypothesis knocking at the door is too late. But, unfortunately, it is not all so clear as that; because, through the necessary imperfections of many post-mortems, cases do continually crop up in which all this cannot be made out, and thus there exists a sort of limbo of imperfectly-observed cases upon which the man who believes in general carcinosis may seize. He may then bring forward his arguments in support of that view, and try to invade the whole field from that doubtful corner. And what are his arguments? I do not like to touch upon the arguments which Sir James Paget so beautifully brought forward. I was delighted, as we all were, with his speech; and I was so impressed with it for a time that it seemed to me that cancer must come not only generally, but even out of the blood. I came into the society with no such belief, and it was nearly a fortnight before I could ever venture to take up the paper and look at Sir James Paget's speech to see what it really was. It then seemed to me (it was a poetic moment, and I was by the seaside at the time) that it was like a beautiful cloud of dying faith, and that when one held the cold hand of reason against it, it condensed into a very few drops. This is shortly all that Sir James Paget advanced. He said that cancer is hereditary, and then, in the next breath, he said, 'So, also, are enchondromata, fatty tumors.' Well, we dispose of that at once by saying this—inasmuch as we are in search of a distinction between the simple tumors and the cancerous, what is the use of bringing in any feature which is common to both? How can what is common to both explain

the peculiarities of one? But then Sir James Paget says it is not only hereditary, but it is hereditary in a very peculiar way; and the peculiar way was this, if I remember rightly, that the cancer does not only strike upon certain parts, but it spreads itself over a variety of organs in the organizations it successively attacks in the family. Now, I am obliged to shuffle a little in meeting that. First, let me say I was not in the least prepared to find that Sir James Paget had come to the conclusion that of every three persons who have suffered from cancer one at least has been hereditarily tainted, because that very morning I had been in conversation with my distinguished colleague, Mr. Birkett, on that very point, and he left me with this impression (which I trust he will take the opportunity of contradicting if I have misunderstood him), that with all his care and pains—and we all know what his care and pains are—after searching through the family history of numerous persons who had come to him with cancer, he was not able to say, with any confidence, that cancer was specially hereditary at all. This is very astounding, but not more so than that Mr. Erichsen and Mr. Hutchinson should say they never saw pyæmia in private practice; and that Sir James Paget and Mr. Hewett should declare they had seen it repeatedly, as frequently as in hospitals. This leads us to the conclusion that individual experience is not to be accepted as establishing a universal proposition. I regret if I should seem to say anything in disparagement of the importance and accuracy of Sir James Paget's observations—nothing could be further from my thoughts; it is only in justice to my position that I feel bound to say what I do. But I have another thing to mention. It will be in the recollection of all members of the society that, on the first evening of the discussion, Mr. Hutchinson drew attention to the very interesting fact (I think he also claimed Mr. de Morgan as having observed it likewise) that warts appear in cancerous families. Well, if warts appear—and that is a new thing just observed, and we are still in a developing world—may not fatty tumors soon appear, and may it not likewise be shown that sarcomas, and I know not what, are also found in cancerous families? If so, then our proposition will take this form—that equally with non-malignant and malignant tumors, you have this peculiar development in all parts. Then I shall lay down my syllogism

again, and say what applies equally to the non-malignant and to the malignant can in no degree explain the peculiarities of the malignant. The last point that Sir James Paget brought forward was that cancer must be general because it so constantly recurs. Well, but the localists pride themselves on the perfection with which they not only explain the recurrence, but actually trace the way in which it does recur, and show how you can make it recur, by leaving a little bit in when you operate, by leaving a patch of gland, by operating so late that the lungs are affected, and so forth. Surely that cannot be an argument in favor of the general origin of cancer—I mean of its arising from general conditions—when the localists profess to be able to explain the whole of it. Sir James Paget said that cancer must be general, because a chance wound or injury produces cancer in parts, in the same way or by an analogous process with that process in which we observe that tubercles, syphilitic, or other admittedly constitutional conditions likewise develop from unusual injuries. That is a long sentence, but what I mean is this—that there is such a parallelism between tubercle and cancer that if you hold tubercle to be constitutional, you must also hold cancer to be so. Now, sir, it is not three years since Mr. Simon, sitting in that chair, showed us proofs that tubercle arises locally. And have we not had specimen after specimen brought forward to prove that people get tubercles through old local patches of dirty cheesy remainders, bronchial abscesses, duodenal ulcers, and so on? All kinds of odd evidence we have had heaped up to show that tubercle comes as an accidental development from a really local disorder. I should be much more inclined to go with Mr. Simon's strictly philosophical view that he gave us in his most able and philosophical speech, when he classed cancer with tubercle. For myself, I would throw cancer and syphilis and tubercle together as disorders which become generalized from a local origin, and very rapidly become so generalized.

"I am very sorry to have occupied the time of the society so disgracefully long, but before closing my speech I should like to point out how wide are the bearings of the question we are discussing. Especially it strikes me that there is a most interesting and important analogy to fevers—the great epidemic fevers. Is any member of the Epidemiological Society

present? One hears so little of the epidemiology of the epidemiologists that we would be delighted if they would come forward and explain to us whether, when in the body corporate fever bursts out, it arises in any local unit of the community as a distinct disorder, and spreads from him contagiously, or whether it infects the body corporate as a body, and bursts out in Jones and Thompson and their successors as out of the general into the particular. Surely there must be a close analogy between the two questions. How vague an analogy, one can, of course, easily see. I can in my own mind feel how long it must be before we can adopt a general formula that will solve these questions; but I feel satisfied that when the solution of the question comes, some general law governing the whole must be discovered."

I think the following general propositions may be considered established:

1. Cancer first affects the body locally, spreads locally, and invades the body along definite tracks (lymphatic and vascular systems).

2. Cancer grows plant-like in a congenial soil.

3. Some soils are more congenial than others to the development of cancer (predisposition), and tissues peculiarly favorable to the propagation of cancer, or the reverse, may be acquired by inheritance.

4. The disease can be completely eradicated by surgical operations; and when they fail, the inference is that they had not been undertaken sufficiently early or with sufficient boldness.

CHAPTER IV.

CANCER OF THE BREAST AND AXILLA.

ALMOST every variety of cancer is met with in the region of the breast, ordinarily becoming disseminated *via* the lymphatic vessels and glands located in the armpit. But cancer may also occur primarily in the axilla.

Cancer may originate either in the substance of the mammary gland itself or in the nipple and areola.

CANCER OF THE NIPPLE.

Cancer may arise in the nipple in one of the two forms: (1) as epithelioma; or (2) as Paget's disease, otherwise called eczema of the nipple.

Epithelioma commencing in the nipple is a rare disease; its physical signs and course are identical with the type already described.

Eczema of the nipple, or Paget's disease, the term being employed in a special sense, must be considered as the initial stage of cancer. It was first recognized and carefully described by Sir James Paget, whose account of it appears in St. Bartholomew's Hospital Reports for 1874 (p. 87 *seq.*); and it is worthy of note that while Sir James appeared before the Pathological Society, as already shown, in support of the constitutional theory, yet, in his able contribution to the reports of his own hospital in the same year, he brings forward, in the following manner, evidence which strongly supports the localists' contention:

"I believe it has not yet been published that certain chronic affections of the skin of the nipple and areola are often succeeded by the formation of scirrhous cancer in the mammary gland. I have seen about fifteen cases in which this has happened, and the events were in all of them so similar that one description may suffice.

"The patients were all women, various in age from forty to sixty or more years, having in common nothing remarkable but their disease. In all of them the disease began as an eruption on the nipple and areola. In the majority it had the appearance of a florid, intensely red, raw surface, very finely granular, as if nearly the whole thickness of the epidermis were removed; like the surface of very acute diffuse eczema, or like that of an acute balanitis. From such a surface, on the whole or greater part of the nipple and areola, there was always copious, clear, yellowish, viscid exudation. The sensations were commonly tingling, itching, and burning, but the malady was never attended by disturbance of the general health. I have not seen this form of eruption extend beyond the areola, and only once have seen it pass into a deeper ulceration of the skin after the manner of a rodent ulcer. In some of these cases the eruption has presented the characters of an ordinary chronic eczema, with minute vesications, succeeded by soft, moist, yellowish scabs or scales and constant viscid exudation. In some it has been like psoriasis, dry, with a few white scales slowly desquamating; and in both these forms, especially in the psoriasis, I have seen the eruption spreading far beyond the areola in widening circles, or with scattered blotches of redness, covering nearly the whole breast.

"I am not aware that, in any of the cases which I have seen, the eruption was different from what may be described as long-persistent eczema, or psoriasis, or by some other name in treatises on diseases of the skin; and I believe that such cases sometimes occur on the breast, and after many months are cured or pass by and are not followed by any other disease.

"But it has happened, in every case which I have been able to watch, cancer of the mammary gland has followed within at the most two years, and usually within one year. The eruption has resisted all the treatment, both local and general, that has been used, and has continued even after the affected part of the skin has been involved in the cancerous disease.

"The formation of cancer has not in any case taken place first in the diseased part of the skin. It has always been in the substance of the mammary gland beneath, or not far from the diseased skin, and always with a clear interval of apparently healthy tissue.

"In the cancers themselves, I have seen nothing peculiar.

They have been various in form; some acute, some chronic, the majority following an average course and all tending to the same end; recurring, if removed, affecting lymphatic glands and distant parts, showing nothing which might not be written in the ordinary history of cancer of the breast."

And then, after drawing parallels between the disease which he has so graphically described and other lesions of the skin and mucous covering of the tongue (ichthyosis) and parts of the intestinal tracts, where, he admits, cancer arises locally from protracted causes of irritation, Sir James Paget writes with regard to the treatment of eczema of the nipple:

"Should not, then, the whole diseased portion of skin be destroyed or removed as soon as it appears incurable by milder means? I have had this done in two cases, *but I think too late*" (italics mine).

Mr. Erichsen [9] points out that there are two ways in which this condition may be explained. "The disease of the nipple may be primary, and by extending down the ducts to the acini may finally determine the development of true cancer in the gland; or it is possible that the primary disease may be in the acini, and that, as a consequence of it, a morbid secretion may exude and irritate the muco-cutaneous surface with which it comes in contact." Mr. Erichsen also quotes a case in support of the latter explanation.

As to diagnosis, there can rarely be any difficulty in distinguishing malignant disease of the nipple and areola from any simple tumor, such as a nævus, or from a cyst, and syphilitic lesions must be excluded by the history of the case or by the test action of antisyphilitic remedies.

M. Darier, in a recent communication to the Société de Biologie, ascribes Paget's disease to the presence of psorospermia or coccidia, which can readily be detected microscopically, and are found in the offshoots of epithelioma of the nipple. He asserts that they were figured by Butlin in 1876, but then regarded as evidence of endogenesis.

Modern students are well aware that cancer is believed by a few to be due to bacterial agency in some form or other. All I can say is that the experiments of Messrs. Ballance and Shattock did not confirm that view, and that the germs found by them in malignant growths were of a non-specific character.

There may be specific germs, still undetected, which cause cancer, or there may not. We know clinically that cancer is contagious, because it may be reproduced either naturally, accidentally, or artificially by grafting; but its contagious properties must be of a very low degree.

At any rate, the treatment of Paget's disease, or of epithelioma of the nipple, must be undertaken very boldly if the practitioner hopes to save the life of his patient. A bare excision of the diseased parts, judged by the naked eye, is useless, as evidenced by Sir James Paget's report of two cases where these operations were undertaken too late.

Let me say, with all the earnestness that I can: if a woman is the subject of malignant disease of the nipple or areola, the growth being of small dimensions—of the size of a shilling or florin, more or less—the sooner the entire breast is amputated so much the better for the patient.

Plenty of practitioners can be found to recommend for such a case milder measures first. They will say the disease is so small they cannot be sure it is cancer; that amputation is too heroic, and removal of the diseased tegumentary area quite as likely to prove successful as the more extensive operation. But these are false and paralyzing conclusions. If the simple excision of the affected skin be carried out, particles of the growth will probably remain beneath in the substance of the breast proper, the natural course of the cancer will merely be retarded a short time, and the case eventually swell the series of the four hundred and ninety-nine recurrences out of five hundred operations as narrated by Sir James Paget.

The sacrifice of an important and useful organ such as the eye, or a less important one such as the breast, should not be made except for a great gain.

Sir William Gull tells us that if he were the subject of cancer he would prefer that he should be attacked by the disease in the eyeball, because the globe could be enucleated while the disease was small. This is the attitude which should be adopted by any practitioner who wishes to benefit the public by operating for cancer. Now, if the excision of the eyeball for a cancerous growth about the size of a pea bears promise (as may be proved by the records of cases) of immunity from recurrence of cancer, it does so because not merely the growth, but a considerable width of tissue beyond the af-

fected area has been removed; the anatomical limit prescribed by nature to the operator being the depth of the orbit. In the case of cancer of the nipple, a surgeon may remove with an infinitesimal amount of danger the entire breast, and, if he please, the pectoral muscles down to the ribs, and the axillary lymphatics as well. And as hopes of immunity from recurrence depend upon the freedom with which the tissues on the proximal side of the cancer can be removed, there is no part of the body (save the extremities) where hopes of permanent cure may so reasonably be indulged in as for cancer of the nipple, if only a sufficiently adequate operation be performed.

Cancer of the Mammary Gland.

Almost every variety of cancer is met with in the mammary gland, the most common of all being scirrhus. The diagnosis of cancer of the breast in its earliest stage is always most difficult. An advanced case of cancer of the breast can ordinarily be recognized in a few moments, but quite the reverse obtains where the patient only complains of slight feelings of pain, of functional disturbance, of some slight retraction of the nipple, of some fulness, tension, or prominence, or small lump in the mammary gland.

The text-books on surgery offer very little help to students in laying down lines by which cancer of the breast may be recognized in its earliest stages; most writers assuming the existence of a well-marked case of cancer, and then pointing out the signs by which the particular variety must be distinguished from the others. Practically, the difficulty lies not in distinguishing the varieties of cancer in the breast from one another, but in distinguishing any particular variety of malignant growth from the benign formations which may simulate it.

Of the recognition of a typical example of scirrhus little need be said. A mass, of almost stony hardness, can be felt near the central part of the breast of a woman past middle age. The nipple will be retracted, and it, as well as the integument, will appear connected, as if by bands, to the growth beneath.

If the breast be ill-developed and pendulous the scirrhous mass will gravitate to its lower part, and by placing two fin-

gers under the organ, the tumor can be recognized by ballotement. Its surface will be irregularly nodulated, but directly continuous with the proper glandular tissue. There will probably be no discharge from the nipple, or, if so, of a scanty character. The skin will be depressed over the growth, and there will be a slight enlargement of the superficial veins. If the disease have attained such dimensions that secondary growths in the lymphatic glands and cord-like prominences of the vessels leading thereto be observed, the breast being fixed to the pectoral muscles, the neoplasm having invaded the skin, and there being small satellite growths around the parent growth present—if any or more of these phenomena exist, there need be no question raised as to the necessity for eliminating other conditions by differential or exclusive diagnosis. But when the scirrhus is of very small size, say that of a nut, or even half the size of a walnut and enveloped in the glandular tissue, the difficulty of forming an opinion, apart from exploration, becomes enormous: yet this is precisely the kind of case where excision of the breast would probably be the radical cure of the disease. If a small-sized scirrhus occur, as it occasionally does, near the periphery of the breast, its physical character will probably serve to distinguish it. If it arise in the centre of the breast, a substantial portion of the breast tissue lying between it and the surface, it cannot possibly be distinguished from a tense cyst except by exploratory puncture or incision.

Scirrhus of the breast commences in a most insidious manner in a large proportion of cases. A considerable area, or perhaps nearly the whole of the organ, becomes affected by minute particles of the growth, which, before they have become fused together, do not appear as a single isolable tumor, but give rise to a very tough consistence of the breast, which requires considerable care to discriminate from a simple non-malignant chronic induration of the organ.

If the breast be grasped between the fingers above and the thumb below, a similar sensation is conveyed to the touch, both in the simple chronic induration and in the early infiltration of malignant diseases, but it is often easy to distinguish between these two conditions by placing the palmar surface of the hand flat upon the breast. If the induration be of a simple character it disappears under this test; if malignant,

the feeling of unnatural hardness rèmains. Doubt may often be cleared up by the application of iodide of lead or iodide of cadmium ointment, spread upon lint and applied to the breast with strapping. If the swelling in the organ has been due to simple chronic induration it will resolve within a few days under this treatment, and the breast will present its ordinary healthy physical signs. On the other hand, should the infiltration be of a cancerous nature, the effect of the ointment and strapping will merely be to render the still normal parts of the breast flaccid, and the cancerous nodules will appear the more prominent. Cases still remain where doubt can only be cleared up by an exploratory puncture or incision, and the great importance of forming an accurate diagnosis at the earliest possible stage of the disease—that its recognition may be quickly followed by extirpation—renders it imperative for this means of diagnosis to be resorted to should the physical signs be obscure or present an ambiguous interpretation to the practitioner.

A small adenoid tumor in the breast is said to be distinguishable from cancer by its mobility; practically, however, the diagnosis cannot be made out until the time of operation. That does not, however, much signify; the only difference as to treatment being that, if a growth believed to be one of simple glandular tissue is found after its removal to be malignant instead, the surgeon must at once perform the major operation.

The multiple fibromata, or neuromata, so called, which are generally located immediately beneath the skin, merely require a passing mention, and could scarcely be mistaken for cancer by any practised observer.

With regard to the cystic adenomata the case is different, and the malignancy or otherwise of these growths cannot usually be ascertained without the aid of the microscope.

Very little can be said of the distinguishing characters of sarcomatous neoplasms which is not to be found in all the text-books; but to point out those features which distinguish these growths from the carcinomata is not of much practical value (save to students preparing for examination), because whether the malignant growth be sarcoma or carcinoma, the same treatment must be adopted. But it occasionally requires careful watching to distinguish a sarcoma from an abscess of

the peculiarities of one? But then Sir James Paget says it is not only hereditary, but it is hereditary in a very peculiar way; and the peculiar way was this, if I remember rightly, that the cancer does not only strike upon certain parts, but it spreads itself over a variety of organs in the organizations it successively attacks in the family. Now, I am obliged to shuffle a little in meeting that. First, let me say I was not in the least prepared to find that Sir James Paget had come to the conclusion that of every three persons who have suffered from cancer one at least has been hereditarily tainted, because that very morning I had been in conversation with my distinguished colleague, Mr. Birkett, on that very point, and he left me with this impression (which I trust he will take the opportunity of contradicting if I have misunderstood him), that with all his care and pains—and we all know what his care and pains are—after searching through the family history of numerous persons who had come to him with cancer, he was not able to say, with any confidence, that cancer was specially hereditary at all. This is very astounding, but not more so than that Mr. Erichsen and Mr. Hutchinson should say they never saw pyæmia in private practice; and that Sir James Paget and Mr. Hewett should declare they had seen it repeatedly, as frequently as in hospitals. This leads us to the conclusion that individual experience is not to be accepted as establishing a universal proposition. I regret if I should seem to say anything in disparagement of the importance and accuracy of Sir James Paget's observations—nothing could be further from my thoughts; it is only in justice to my position that I feel bound to say what I do. But I have another thing to mention. It will be in the recollection of all members of the society that, on the first evening of the discussion, Mr. Hutchinson drew attention to the very interesting fact (I think he also claimed Mr. de Morgan as having observed it likewise) that warts appear in cancerous families. Well, if warts appear—and that is a new thing just observed, and we are still in a developing world—may not fatty tumors soon appear, and may it not likewise be shown that sarcomas, and I know not what, are also found in cancerous families? If so, then our proposition will take this form—that equally with non-malignant and malignant tumors, you have this peculiar development in all parts. Then I shall lay down my syllogism

again, and say what applies equally to the non-malignant and to the malignant can in no degree explain the peculiarities of the malignant. The last point that Sir James Paget brought forward was that cancer must be general because it so constantly recurs. Well, but the localists pride themselves on the perfection with which they not only explain the recurrence, but actually trace the way in which it does recur, and show how you can make it recur, by leaving a little bit in when you operate, by leaving a patch of gland, by operating so late that the lungs are affected, and so forth. Surely that cannot be an argument in favor of the general origin of cancer—I mean of its arising from general conditions—when the localists profess to be able to explain the whole of it. Sir James Paget said that cancer must be general, because a chance wound or injury produces cancer in parts, in the same way or by an analogous process with that process in which we observe that tubercles, syphilitic, or other admittedly constitutional conditions likewise develop from unusual injuries. That is a long sentence, but what I mean is this—that there is such a parallelism between tubercle and cancer that if you hold tubercle to be constitutional, you must also hold cancer to be so. Now, sir, it is not three years since Mr. Simon, sitting in that chair, showed us proofs that tubercle arises locally. And have we not had specimen after specimen brought forward to prove that people get tubercles through old local patches of dirty cheesy remainders, bronchial abscesses, duodenal ulcers, and so on? All kinds of odd evidence we have had heaped up to show that tubercle comes as an accidental development from a really local disorder. I should be much more inclined to go with Mr. Simon's strictly philosophical view that he gave us in his most able and philosophical speech, when he classed cancer with tubercle. For myself, I would throw cancer and syphilis and tubercle together as disorders which become generalized from a local origin, and very rapidly become so generalized.

"I am very sorry to have occupied the time of the society so disgracefully long, but before closing my speech I should like to point out how wide are the bearings of the question we are discussing. Especially it strikes me that there is a most interesting and important analogy to fevers—the great epidemic fevers. Is any member of the Epidemiological Society

prohibit the operation. Neither was it likely that the entire disease was excised even by the most experienced operators of the day. Excision of the breast, therefore, was a most dangerous and only palliative proceeding.

The dangers and pain consequent upon the after-treatment and dressings of the wound were in themselves sufficient to prevent any one, short of a Spartan, walking into an operating theatre with open eyes; and the use of caustics, painful though they were, procured temporarily as good or better results with fewer disadvantages than the ancient operative surgery of cancer. But the introduction of anæsthetics and antiseptics have strongly turned the scale the other way. The risks of the operation both immediate and secondary are now exceeding small; there is no acute pain, but merely the slight discomfort of the anæsthetic, for the patient to submit to at the time of the operation and during the subsequent dressings. Convalescence ordinarily takes place within a week or fortnight. On the other hand, the pain of the caustic treatment is only just tolerable, and, even since the introduction of cocaine, complete local anæsthesia must be limited to a small area. When caustics are employed to destroy a cancerous growth of any considerable dimensions, the results are far inferior to excision or amputation under modern conditions. The bulk of the growth is hardly ever eradicated, and manifest local recurrence occurs ordinarily after the lapse of a few weeks. The caustics are applied and reapplied, and this sad treatment goes on until the patient is relieved by death of a treatment which adds pain to that of the disease, which it ordinarily aggravates. However, in some cases of cancer of the breast in very old and debilitated subjects, where an open ulcer is found and the subjacent tissues are immovably fixed to the ribs, the disease may be palliated and the offensive discharge arrested for a while by employing some kind of caustic. The local anæsthetic cocaine should be employed. Some time ago I had a caustic paste made for me by Messrs. Hooper & Co., consisting of 20 grains of hydrochlorate of cocaine, 120 grains of caustic potash, and 60 grains of vaselin.

The cancerous ulcer and its surrounding area is first well cleansed with pledgets of cotton wool dipped in water, and then a weak solution of hydrochlorate of cocaine (four per cent) is painted over it. In a few minutes a small quantity

of the caustic paste is rubbed into the growth with a small wooden spatula, and the caustic quickly chars and destroys the tissues with which it comes in contact. By this plan a considerable quantity of cancerous growth may be destroyed in about twenty minutes, and the application may be repeated on three or four subsequent occasions after variable intervals.

Let me repeat, the only cases where caustics should be recommended are those where the affected area is small, and where, on account of some special surgical, anatomical, or medical reason, attempts to completely eradicate the disease by some feasible surgical operation are impracticable. In cases too far advanced for operation, Chian turpentine is perhaps the best drug which can be administered internally. It certainly has a specific action of some sort upon cancer, though its beneficial effects seem to be more manifest in cancerous disease of the tongue and uterus than in that of the breast.

The drug must be exhibited in full doses, in the form of an emulsion, extended over a long period. It appears to reduce the quantity of discharge from a cancerous ulceration and to mitigate pain. The toughness and infiltration, as appreciable to the touch, around the base of the cancerous growth, partially disappears under the influence of this medicament. Whether Chian turpentine or any of its congeners really possess powers which render the normal tissues insusceptible to the invasion of malignant growths or destructive to the growths themselves is a question of such great importance that the mere fact of failures, reported by some, ought not to deter us from further investigating the matter, as there is the positive and authentic evidence of a few cases, recorded upon the highest authority, where Chian turpentine appears to have actually cured cancer. Neither can the specific action of arsenic be denied, in view of the results which have followed its internal administration or injection into sarcomatous neoplasms.

Cancer of the Axillary Glands.

Cancer of the axillary glands may be either primary or secondary. Ordinarily, cancer in these glands is sequent to the breast affection, and the appearances presented are so common as hardly to need any description. It is an error to

suppose that sarcoma of the breast does not often generalize through the medium of these glands as well as through the vascular system. The difficulty, if any, which is met with in recognizing the enlargement of the glands which are affected with cancer of the type of the parent disease, is when they lie imbedded in an unusually large quantity of adipose tissue. There may often be no enlargement of the glands perceptible to the touch, as examined through the skin, and yet, at the time of the operation, a cluster will often be unmasked upon the surgeon passing his forefinger into the axillary space. The fact that the glands become affected by the direct conveyance of cancerous material from the parent growth through the lymphatic vessels must never be forgotten at the time of operating. Only too often the cancerous breast and axillary lymphatic glands have been removed extensively enough, but some portions of the minute lymphatic vessels leading to the glands have been overlooked, naturally giving rise to local recurrence within a short interval of the time of the operation. Indeed, in a more minute knowledge than I am afraid many practitioners possess of the anatomy of the lymphatic system, lies the key both to the pathology and to the successful treatment of cancer by extirpation.

Primarily cancer occurs in the axillary lymphatic glands either as scirrhus or as lympho-sarcoma. As the growth attains sufficient size to press upon the important vessels and nerves which traverse the boundaries of the space, the pressure signs of œdema and pain will appear. The treatment is, of course, early extirpation.

Cancer is rarely met with in the rudimentary breast of the male, but its recognition and treatment do not present peculiar difficulties.

CHAPTER V.

CANCER OF THE UTERUS.

THE uterus may be attacked by varieties either of sarcoma or carcinoma, but sarcoma of the uterus is so rare as scarcely to deserve mention.

By far the most common form of uterine cancer is that of epithelial type, originating from the cells and glands of the mucous membrane lining the interior or exterior of the cervix, and microscopically will be epithelioma, encephaloid, or scirrhus.

Cancer commencing in the body of the uterus is very rare, and fortunately so, for, on account of the difficulty which surrounds its detection in its earliest stage if it occupy this position, and the probability that the disease will have affected the parametrium before the organ has been excised—and this serious operation is the only radical measure at our disposal for cancer of the body of the uterus—renders the body of the uterus one of the most dangerous sites for primary cancer.

With regard to cancer commencing in the cervix uteri, the opposite conditions prevail. Next to the breasts, I believe the cervix uteri is the most common site for cancer; and the cervix being readily accessible both to the touch and to inspection, not merely can any ordinary case of cancer of it be recognized immediately upon examination, but certain conditions which notably predispose to cervical cancer can also be recognized, which being fortunately of a character readily amenable to treatment, it follows that a class forming a large proportion of the entire series of cases of cancer are preventable.

Out of all women at or after the middle period of life, when uterine cancer is most commonly met with, the cervix uteri will upon examination be found to present one of two general conditions.

First, the cervix will be of shape and outline more or less

in conformity with the normal; perhaps a little conical; but the vaginal surface of the cervix will be clothed with healthy mucous membrane, the os externum normal in outline, and there will be no laceration or erosion of the cervix. If such a cervix ever becomes affected with cancer we expect the disease to arise within the mucous membrane lining the cervical canal, as the result of chronic endocervicitis, and by radiating from this focus to infiltrate and cause a marked enlargement of the cervix, eventually breaking down and leaving a characteristic ulcer.

If the case be examined before ulceration with its marked physical signs has supervened, the cancerous process can ordinarily be affirmed by the smart hemorrhage which will acompany the act of gently scraping the interior of the cervical canal with a blunt curette, or, if the instrument be applied more forcibly, by the ease with which portions of the cervical tissue will crumble away, the débris being the cancerous tissue. Of course, it is of the last importance to distinguish between the infiltration of the cervix due to cancerous deposition and the simple chronic induration which often simulates the more formidable condition. And the difficulty of so doing is increased when we remember that the chronic induration of the cervix so called is often but the premonitory stage of cancer; therefore if any doubt exist as to the nature of the indurated cervix under examination, the infra-vaginal portion of the cervix should be removed with a galvanic wire écraseur and examined microscopically. This is a very simple operation, and one quite unattended with appreciable risk. After the infra-vaginal portion of the cervix has been removed, any small focus of cancerous growth situated within the cervical canal will be detected. If found, it must be presumed that that portion of the cervical mucous membrane remaining in the uterus above is, if not already infected, about to become so, and the operation must be completed by thoroughly scraping out the canal with curettes and thrusting the conical point of Pacquelin's cautery around the denuded surface.

Such an operation will probably suffice to prevent recurrence of cancer in cases where the growth is exceedingly small and still quite localized; and abnormal hardness or induration of the cervix is the chief sign by which the commencement of malignant disease must be suspected. If the

disease have already extended so far that the normal mobility of the uterus is diminished, the mere excision of the infra-vaginal or even supra-vaginal portion of the cervix will probably be quite inadequate to prevent local recurrence of the disease at some later period. Therefore the anticipated recurrence should be forestalled by excision of the entire uterus. Let me repeat that excisions of the infra-vaginal portion or supra-vaginal portions of the cervix uteri which can be performed without opening the peritoneal cavity and with very slight risk to life, should be undertaken for cases of early cancer localized in the lower part of the cervix or for induration of the cervix so marked as to be considered premonitory of the advent of malignant disease. By this means an area of tissue above the diseased focus sufficiently wide to insure immunity from recurrence will have been removed, but if the neoplasm have transgressed this narrow limit, no operation short of excision of the entire uterus can be undertaken with hopes of radical cure.

In the consideration of cancer of the breast, even if only the nipple be attacked, excision of the entire breast is to be advocated. In some respects the nipple might be compared to the cervix and the breast to the body of the uterus. We know how important it is, when any organ is affected with cancer, that the entire organ should be extirpated, and the reasons why this principle is commonly departed from in early cancer of the cervix are that, owing to the peculiar conformation of the uterus, the cervix is to some extent insulated from the body; but, above all, the serious nature of uterine extirpation does not justify its performance while results prove the satisfactory nature of the minor operation.

Were the percentage mortality of vaginal extirpation of the uterus very low, like that of excision of the breast, then uterine excision should ordinarily be performed for cancer of its cervix. And I am not prepared to say that in a few years' time, after greater experience has been gained of the somewhat rare operation of vaginal extirpation of the uterus, it will be resorted to with far greater frequency than it now is, as certainly its dangers are not so great in the earlier as compared with the later stages of cancer. (The mortality of vaginal extirpation of the uterus may now be considered reduced to ten per cent.)

In a second and very large group of cases in which the uterus is examined at those periods of life when cancer most commonly occurs, the cervix is found lacerated in two or three places. These lacerations have occurred during labor; and I believe that immediately after the birth of the child is the proper time to repair the cervix, if torn, by the insertion of a necessary number of sutures. If this were done the gynæcological departments of our hospital would be relieved of a considerable number of patients, and the sum total of women suffering from diseases peculiar to the uterus correspondingly diminished. A tripartite or bipartite laceration of the cervix is followed by ectropion, and upon one or other of the everted lobes of the cervix an erosion soon occurs. I say nothing of the leucorrhœal discharge or the various subjective symptoms which accompany this condition, but when it exists a most favorable site for the occurrence and growth of cancer is presented; and if a badly-fitting pessary be injudiciously adopted, or if a pessary be worn and not cleansed and changed with sufficient frequency, the probability that cancer will supervene increases. The erosion on one of the lobes of the fissured cervix in time deepens into a distinct ulceration, and the lobe, increasing in size, forms the "tuberous" or "polypoid" or "cauliflower" cancer of the older writers.

Thus arise the very commonest forms of cancer of the uterus, not quickly and without warning, but some time after a laceration of the cervix has been sustained during parturition. As to the prevention of cancer in these cases, the repair of the cervix after childbirth, as already pointed out, can be effectively done in a few minutes, or after the period of involution is accomplished the cervix can be readily repaired by Emmet's operation. For my part, I think that in most cases it is simpler and better to remove the cervix above the lacerated portion with a galvanic wire, in preference to resorting to plastic operations, and especially if the fissures be multiple and deep, and the lobes present appearances deviating from the normal.

In March, 1886, I delivered two lectures at the Cancer Hospital on excision of the entire uterus for cancer, the basis of the lectures being the case of Mrs. R., in which destruction of the major portion of the cervix by caustics had failed, and where I performed successfully vaginal excision of the uterus

on October 30th, 1885. The fact that recurrence took place in the vaginal roof and parametrium—the patient dying on January 3d, 1887, and having survived the operation one year and two months—in conjunction with an examination of the cancerous uterus after its removal, led me to believe, at the time I delivered my lectures, that excision of the entire uterus should be usually performed, to the exclusion of other methods of treatment, as soon as the diagnosis is established. For reasons already given, I now qualify this opinion, and would be contented with recommending the minor operation where the disease is exceedingly small. But if, after the performance of excision of the vaginal portion, the extent of the disease appears of wider limits than was believed prior to the operation, then is the accepted time to excise the remaining portion of the uterus, and, if necessary, the upper portion of the vagina. By neglecting to perform this operation till recurrence has taken place, its gravity will be enormously increased; and if the operation succeed, the prolongation of life will probably only be calculated by months. I have only on one other occasion, besides the case already referred to (and the complete history of which was published in my "Lectures"), performed vaginal excision of the uterus for cancer. I operated, on July 23d, 1886, upon Mrs. S., æt. 67, for a case in which the entire uterus was infiltrated with cancerous deposition. The patient preferred to run the risk of extirpation of the uterus in preference to remaining in the intense agony she was suffering. I regret to say that this patient died four days after the operation; but a post-mortem examination not having been allowed, I am unable to state the anatomical appearances of the pelvis.

As to the details of extirpation of the uterus by abdominal section I will say nothing, because, after carefully examining the records based upon the variously modified plans which have been proposed or carried out for excising the uterus, my view is that (apart from cancer of the uterus complicated by pregnancy or other unusual conditions) if the uterus is to be excised the operation should be performed through the vagina. From numerous trials of different modifications upon the dead body, and from an investigation of the recorded examples both of failures and sucesses, the mortality should not exceed that of most other capital operations where the peritoneal cavity is opened.

Procrastination is the chief source of danger. Patients ordinarily take so much time to make up their minds before undergoing a capital operation for cancer, and usually find so many who advise them to hesitate before undergoing an operation which carries risk to life, and they waste so much time in considering cures, both genuine and apocryphal, which are brought before them through all kinds of channels, that the operation is only asked for as a forlorn hope to mitigate suffering or to prolong life, instead of being demanded in a very early stage of the disease, when its dangers would be relatively small and the hope of radical cure great.

As the result of investigations elsewhere published,[10] I have devised certain instruments to facilitate this operation, which I recommend should be performed in the following manner:

1. There may be two semilunar vaginal incisions or one circular one. If the circular incision be chosen, the divided vaginal arteries can be readily secured by hemostatic forceps. Before the incision is made, the cervix should be well drawn down, thoroughly exposed, and the finger passed along the line of the proposed section, which should be principally made with blunt-pointed scissors or a probe-pointed bistoury. The bladder should be supported with a staff throughout the operation.

2. The ureters are to be separated from the sides of the uterus with the fingers, and the peritoneum stripped upward over the organ as high as possible, so that after its removal a funnel-shaped peritoneal flap will remain.

3. The uterine arteries should be secured prior to division.

4. The uterus should not be flexed, since such a course involves great difficulty in dealing with the broad ligaments, and might add to the risk of sepsis from the cancerous cervix.

5. The broad ligaments are to be secured as follows: The peritoneal cavity having been freely opened in front of and behind the uterus, tearing through the peritoneum with the finger-nails, the operator's left hand is to be introduced into Douglas' pouch and the uterus pushed upward toward the abdominal cavity in order to gain space. A loop of stout carbolized silk must be passed upward in front of the uterus, by means of a staff shaped like a vesical sound, having a notch for the silk at the top of its beak. This loop can be caught by the tips of the left index and middle fingers at the summit

of the uterus and one end drawn downward. By a similar manœuvre a second loop can be passed over the other broad ligament. Perforated shot are to be slipped upward, each embracing a ligature, and clamped by pressure with a forceps, firm traction having been previously made upon the ligatures. The broad ligaments are secured close to the uterus.

6. Two courses are now open to the surgeon. By the first a stout pair of Wells' pressure-forceps is applied to each broad ligament external to the silk ligatures, and the uterus then excised with scissors. In this case the silk ligatures will have served the purpose of temporarily compressing the broad ligaments and of depressing them into the jaws of the pressure-forceps. The forceps will be allowed to remain *in situ* for some hours, in order to prevent hemorrhage, and the operation completed as in the case of Mrs. R. By the second course double ligatures must be applied to the alæ vespertilionis, and these structures divided on either side between the double ligatures. The operation will then be completed by closing the peritoneal cavity, after the manner ordinarily adopted in abdominal operations.

It has been argued that the Fallopian tubes are part of the uterus, and therefore, unless they be removed also, excision of the uterus only, for cancer, is an imperfect procedure. Without discussing this debatable point, I will content myself by stating that after the excision of the uterus in the manner indicated, the operator can, if he please, draw down consecutively each appendage, apply a ligature, and remove it. But in so doing, care must be exercised to avoid including the ureters in the ligatures. Virginity naturally increases the difficulty of vaginal hysterectomy. In one of the operations I performed upon the dead body the subject was a virgin, and it became necessary to incise the hymen in the median line with scissors. It was not necessary to divide the perineum, and the vagina was readily distended to a size large enough to admit the introduction of the entire hand. Deformity of the pelvis would seriously complicate the operation, and this or other conditions which occasion diminution of the genital passage would guide the operator to choose the abdominal in preference to the vaginal operation, where hysterectomy is advisable.

Uterine Cancer complicated with Pregnancy.

When a woman, the subject of cancer of the uterus, becomes pregnant the complication is a most serious one. In the earlier months of pregnancy it is often next to impossible to diagnose the condition. The hemorrhages from the cancerous cervix mask the sign of catamenial suspension which obtains during pregnancy; the fixity of the lower zone of the uterus, and sometimes the size of the cancerous growth, mask the sign of internal ballotement; the fœtal heart is only audible during the later months of pregnancy; and should the fœtus be dead, there will necessarily be an absence of its cardiac murmurs, and its active movements, which, were it alive, would conclusively demonstrate the existence of pregnancy.

The reported cases are not sufficiently large to lay down precise rules which must be considered binding in every case, but I can recommend the following suggestions as useful to bear in mind:

1. In cases of early cancer of the cervix complicated with pregnancy, the entire gravid and cancerous uterus can be excised per vaginam prior to the third or fourth month of utero-gestation.

2. From the fourth to the sixth month the cervix may be excised with a galvanic wire cautery and premature labor induced.

3. From the sixth to the ninth month the entire gravid and cancerous uterus had better be removed by abdominal section, should the extent of the disease be considered such as to constitute a bar to delivery.

As the operation of abdominal excision of the pregnant and cancerous uterus is exceedingly rare, I cannot do better than quote the description given of it by Sir Spencer Wells,[1] relating to a case which was, when performed on October 21st, 1881, the only one of the kind followed by recovery and a temporary restoration to health:

"The patient was secured as for ovariotomy; but as it was necessary to keep a catheter in the bladder, an opening was made expressly for it in the waterproof covering. The vagina was plugged with thymol cotton wetted with warm water containing about one per cent of phenol. I divided the

abdominal wall in the middle line to an extent of about eight inches, from two inches above to six inches below the umbilicus. The uterus thus exposed was about the size of a large adult head. After turning it out I inserted four sutures in the upper part of the wound over a large flat sponge, so as to keep back the intestines and protect the abdomen from needless cooling by the spray. I found the ovaries at a higher level and nearer to the fundus than was expected, and it was quite easy to secure the spermatic artery, first on the left and then on the right side, by transfixing the broad ligament below each ovary and tying with strong silk. I took the catheter as my guide in dissecting the bladder from the anterior surface of the uterus. The expanded uterine coats were very thin, like a tense cyst, and they soon accidentally ruptured. I punctured the protruding membranes, and a quantity of liquor amnii escaped. The next thing was to draw out the fœtus and tie and cut the cord; but I did not interfere with the placenta. I then separated the attachments between uterus and vagina, completely circumcising the neck, and securing by pressure-forceps all bleeding vessels as they were divided. The entire uterus, with all the diseased parts about the os and cervix, was thus removed. The forceps were then taken off successively, and every bleeding vessel tied with carbolized silk. Then taking out the vaginal plugs, I brought together the opening into the vagina and the edges of the divided broad ligaments with silk sutures. The pelvis was carefully cleansed, the wound closed as usual with silk sutures, and the ordinary dressing applied as after ovariotomy. The patient was under the influence of methylene for about seventy-five minutes, but the operation from beginning the incision to closing the wound was completed within an hour. Mr. Cadge kindly noted the time occupied by the different stages of the operation as follows:

"2:35 P.M. Patient began to inhale methylene.

"2:41. Catheter and plugging vagina.

"2:50. Incision in abdominal wall.

"2:53. Uterus drawn out.

"2:56. Sutures in upper part of abdominal wall, dividing broad ligaments and vagina, removing fœtus and securing vessels, till—

"3:10. Uterus removed.

"3:40. Ligature of vessels and sutures of vagina and broad ligaments.

"3:50. Closing of wound and dressing.

"3:55. Patient in bed."

This operation was performed when the patient was about a week over the sixth month after conception.

Cases of uterine cancer too far advanced for operations, or in which operations are for other reasons contra-indicated, should be treated locally by insufflations of charcoal, tannin, and iodoform judiciously employed, alternated with weak vaginal injections of some disinfecting fluid, such as corrosive sublimate (one in five thousand), permanganate of potash, or carbolic acid. In this connection must be pointed out the probably specific value of Chian turpentine, introduced to the notice of the profession by Dr. Clay some years ago. Dr. Clay has published several cases of cancer cured by the internal administration of Chian turpentine, combined with other treatment; and for reasons which are at present inexplicable, the drug appears to act most advantageously in cases of cancer of the uterus and of the tongue. Of course the objection raised to believing that this drug has cured any of the cases reported by Dr. Clay is that so many independent observers have tested the treatment and believe it to be useless. Doubt has also been thrown upon the diagnosis of Dr. Clay's cases. But some of them have been reported in full in the "Lancet," the diagnosis having been confirmed prior to the treatment by surgeons of the highest professional reputation.

In one case of uterine cancer, under the care of Dr. Bury, of New Barnet, the diagnosis of encephaloid cancer was confirmed by Dr. Playfair, who was astonished to find, on examining the patient some twelve months later, that she was practically cured of cancer of which he had thought "she could not last many weeks." In this case treatment by Chian turpentine mixture was commenced about October, 1883, with local applications of tannin and charcoal. The disease resolved within a few months, but the treatment was persevered in for nearly a year, and there was no recurrence of the disease when Dr. Bury reported the case in the "Lancet" in November, 1886.

Chian turpentine does not yield immediate results, and if employed should be given in full doses and exhibited over long

periods. Personally I have not given this remedy the full trial which I desire. I have prescribed it in numerous cases of very advanced cancer; in these it has not prevented a fatal result, although there has usually been observed a diminution of the discharge and hemorrhage from the ulcerated growths, with a disappearance of the induration around their bases. The growths indisputably assume an altered appearance while the patients are under the influence of this medicament, and as its use is of a perfectly innocuous character, I do not consider it right to withhold it in apparently hopeless cases. On the other hand, I certainly have not sufficient confidence in its action to advise resort to this remedy to the exclusion of surgical measures in cases where the cancerous growths can be freely and completely eradicated without appreciable risk to life. But I hold that the abundant opportunities of thoroughly testing remedies reputed to exert a specific influence upon cancer afforded by those cases where the anatomical surroundings of the growths negative surgical interference should be made the most of, provided there be any evidence, however small, which justifies the hope that benefit may follow the exhibition of the specific remedy. Knowing, as we do, that syphilomata will often resolve after full doses of iodide of potassium have been administered over lengthy periods, which were quite unaffected by small doses of this specific drug, and that a course of antisyphilitic treatment prolonged over two years is ordinarily recognized as necessary to eradicate syphilitic virus, we should not be surprised to find that Chian turpentine, or some other agent at present undiscovered, may procure a resolution of cancerous growths—acting not more empirically than mercury and iodide of potassium do upon lesions resulting from the syphilitic virus.

We have spoken of cancer as being a local disease, meaning one which commences locally and afterward invades the system, and therefore the early destruction of its primary manifestation as its rational treatment. Syphilis, though a blood-poison, also invades the system through a point of inoculation, at which arises the hard chancre. Now, the hard chancre is nothing more or less than a small local laboratory from which in a few days the poison rapidly invades the lymphatic system. Admitting the very different and essential nature of the specific poison of syphilis from the cells which

have become possessed of the specific powers of cancerous infiltration, yet in both instances the materies morbi is manifested locally; in the case of syphilis very rapidly and in the case of cancer more slowly infecting the lymphatic system. It is only by the comparative slowness by which the lymphatics become invaded by cancer, I may repeat, that the reasonable hope of eradicating the disease by operation exists, if operative treatment be adopted sufficiently early to get beyond the disease.

In the case of syphilis, since almost never-failing specific remedies are now recognized, the importance of endeavoring to prevent the lymphatic affection by destroying the chancre before it has arrived at maturity is not so great—though that is a most rational form of treatment. I believe syphilis can be aborted or prevented by the very prompt destruction of the primary chancre, as evidenced by a case I published in the "Lancet" (1886, Vol. II., p. 128), and that this course should be adopted, as it generally used to be before the specific power of mercury was known; yet the difficulty of seeing cases of syphilitic chancres sufficiently early to be able to destroy them in time to prevent lymphatic invasion by the virus is infinitely greater than to see cancerous patients in a correspondingly early stage. Practically, therefore, for syphilis we have two broad lines of treatment: first and most important, specific remedies, well known and tested—mercury and iodide of potassium; secondly, destruction of the primary lesion in its earliest possible stage, to prevent if possible glandular infection. With cancer the two parallel courses are reversed in importance: we must first chiefly rely upon local extirpation by surgical measures which are well-known and well-beaten tracks; and, secondly, we may try specific remedies, so called, about which we have more to learn.

CHAPTER VI.

CANCER OF THE VAGINA AND VULVA.

CANCER of the upper portion of the vagina is commonly the result of extension downward from malignant disease commencing in the cervix, though as a primary disease cancer of the vagina is exceedingly rare. When found, an ulceration is noticed in the anterior or posterior fornix presenting the appearances of epithelioma. This condition may be caused by the continued irritation of a badly-fitting pessary, and is distinguished in its early stages from syphilitic ulceration by the history of the case, by the physical signs, and by the failure of antisyphilitic remedies. The upper portion of the vagina, on account of its contiguity to the bladder in front, the rectum behind, and the peritoneum above, is one of the most dangerous sites for the occurrence of primary cancer. It is only in the very earliest stages that hope of extirpating the disease, either by excision or by scraping away the ulcerated tissue with its surroundings and freely applying Paequelin's cautery, can be indulged in by the practitioner; and the choice between different operative measures must always be decided by the anatomical position and extent of the disease in the particular case under consideration. Examples of malignant disease of the clitoris, usually epithelioma, more rarely scirrhus, and sometimes rodent ulcer, are cases more frequently met with in practice. The physical signs ordinarily render the diagnosis easy, though difficulty sometimes occurs in distinguishing rodent ulcer from lupoid, tubercular, or syphilitic lesions, any of which may form its precursors.

The early recognition of any form of malignant disease commencing in the clitoris or labia is of great importance, because in such cases the diseased tissues can be readily removed by the galvanic-wire cautery, the growth having been isolated by transfixion beneath, with needles inserted at right

angles to each other. If the vestibule and lower portion of the urethra be involved, the tissues can be safely removed as deeply as the os pubis, and the lower part of the urethra can also be excised, leaving no impairment of the urinary functions. The rapidity with which healing occurs after operations upon the vulva and the sound cicatrices which ordinarily result justify a good prognosis for early cancer of this region.

CHAPTER VII.

CANCER OF THE PENIS, SCROTUM, AND TESTICLES.

ABOUT five-sixths of the cases of cancer of the penis occur in those who are uncircumcised and the subjects of phimosis. In most cases epithelioma—the form of cancer of the penis nearly always found—is consequent upon venereal disease. The following case is in many respects very instructive:

Some years ago a milkman consulted me on account of an offensive discharge which issued from beneath the foreskin, which was phimosed, inflamed, œdematous, and indurated in the region of the cervix. There were small hard buboes in both groins, and there was a history of excessive illicit connection. I at once did what I would recommend to be done in every case presenting a similar history and similar physical signs—caused the patient to be anæsthetized, and, passing a director beneath the foreskin in the middle line, slit the prepuce with Pacquelin's thermo-cautery. The foreskin being thus laid open, the appearances were very much what was anticipated: a good deal of pent-up, offensive secretion was removed with pledgets of cotton-wool from a partly warty and partly ulcerated mass adherent to the corona glandis, the cervix, and the prepuce. The penis was thoroughly cleansed in a weak solution of corrosive sublimate, and the whole of the growth scraped away, and its base with those surroundings which were of an abnormal character touched with the point of the cautery. The patient was placed in bed, applications of iodoform ordered for the penis, and necessary medicaments (non-specific) prescribed internally.

At this juncture two propositions occurred to me: (1) that it was doubtful whether the disease was epithelioma or syphilitic ulceration approaching a phagedenic type; and (2) that no cutting operation was then admissible as liable to promote septic infection through the incision.

Under the use of antiseptics the penis assumed a healthier condition in a few days, but then a rose-rash appeared on the chest and there were other signs of secondary syphilis. Under antisyphilitic remedies, which were now pushed both locally and internally, the lesion on the penis did not entirely heal. Of course the œdema of the prepuce had subsided, but the growth and ulceration in the region of the corona reappeared.

The diagnosis was now unmistakable; the case was one of syphilis and epithelioma co-existing, but the glandular enlargements in the groin were probably due to syphilitic infection only. The penis was amputated at a point about an inch in front of the pubes, and recovery was rapid. I strongly advised the patient to continue a course of antisyphilitic remedies for two years, which he promised he would. But a few months later he saw me again, complaining of multiple swellings (gummata) over the cranium and a slight reulceration in the stump of the penis. He told me he had discontinued treatment because he "felt quite well." He had unfortunately resumed immoral habits, and stated that the stump of the penis was quite adequate for the purpose of copulation; in fact, that he had not noticed any difference whatever in his capacity for coïtus after the loss of five-sixths of the penis. Full doses of iodide of potassium with small doses of perchloride of mercury caused a speedy resolution of the cranial gummata, and the ulceration on the stump of the penis soon got well with applications of iodoform. I managed, with a good deal of difficulty, to keep the patient under observation for about a year, during which time he remained quite well, but he has not continued to report himself to me from time to time as requested.

This case is quoted as illustrative of epithelioma complicated with syphilis and phimosis, complications of frequent occurrence in practice, and always leading to difficulties of diagnosis and of treatment.

When epithelioma attacks the penis, it usually arises beneath the foreskin from warts situated near the cervix or corona. Less frequently the disease commences in the cicatrix of an old chancre, or as an infiltration and ulceration arising *de novo* upon the glans penis.

Accumulations of smegma preputii beneath a phimosed

foreskin are not infrequently the starting-point of cancer. A difficulty always arises in diagnosing epithelioma just arising out of venereal warts. The only tests which can be applied are the presence of ulceration of epitheliomatous type or of induration at the base of the growths.

The treatment of cancer of the penis can be summed up in the words, "early amputation;" and the sooner the operation is undertaken so much the better for the patient, for the following reasons: If the growth be small and the diagnosis made as early as possible, before infection of the inguinal glands has occurred, the penis may be amputated at some point anterior to the pubes; the disease will be eradicated and the sexual function not injured: but where the cancerous growth has already invaded the organ to a marked extent, and especially if deposition has taken place in the lymphatic glands, the entire penis must be amputated by Pearce Gould's method of dividing the scrotum, etc. Of course the lymphatic glands will also have to be excised, and the entire operation must certainly be deemed of a grave character; besides, other considerations arise, often rendering it expedient, after the penis has been completely extirpated, to remove the testicles also.

As long as we believe, with our forefathers, that prevention is better than cure, so long shall we sedulously recommend circumcision in all cases where the foreskin is long, or in cases of phimosis, as materially diminishing the chances not only of cancer of the penis, but also of the inception of syphilis.

Epithelioma is the form of cancer which peculiarly affects the scrotum. The corrugations and anatomical characteristics of the scrotum afford a *locus minimæ resistentiæ* for the production of cancer.

Epitheliomatous disease is not so frequently to be observed now as in former days, on account of the abolition of chimney-sweeping by means of climbing the interiors of the chimneys. The soot used to lodge in the folds of the scrotum, and by its irritation produced epithelioma. Sir James Paget has pointed out that while soot has the peculiar property of readily inciting epithelioma in the scrotum, coal-dust has not. It appears to me that the particles of soot being finer than those of coal-dust, they would the more readily lodge, and be the more difficult to remove by washing from the folds of the scrotum.

But epithelioma of the scrotum at the present day is a rare disease. It does not present any difficulty of recognition in its earliest stages. The scrotum is a part of the body isolable to a great extent, and any small-sized epitheliomatous growth in it ought to be freely excised as soon as detected, with an exceedingly good prognosis.

It seems difficult to understand how epitheliomatous disease can ever be allowed to attain considerable dimensions upon the scrotum; and if the disease has returned after excision or treatment by caustics, it would in most cases appear to be the result of inadequate treatment.

Both sarcoma and carcinoma attack the testicle. When sarcoma occurs it is usually the small round-celled variety, and both testicles may be invaded. This is one of the most fatal forms of cancer, occurring at almost any period of life, though usually in boys before puberty—before the spermatoblasts (epithelial cells) have undergone evolution. Round-celled sarcoma of the testis, if unchecked, runs its course to a fatal termination ordinarily within two years from its commencement. The disease generalizes through the lymphatic glands, and after death secondary growths can usually be found disseminated in most of the important organs. In every respect small round-celled sarcoma of the testis is one of the most malignant varieties of cancer. Not so malignant, and rarer, is spindle-celled sarcoma. It never attacks both testes, and in a considerable proportion of cases undergoes cartilaginous degeneration. Non-malignant, purely cartilaginous tumors are occasionally met with in the testis; but as it must be impossible to exclude the existence of sarcoma-cells, early extirpation of such tumors must be recommended.

Sarcoma of the testis not infrequently undergoes cystic degeneration, and older writers usually have described such cases as cystic disease of the testicle.

Sarcoma, as already mentioned, is usually met with before puberty and very commonly before ten years of age. When carcinoma attacks the testis, springing as it does from the cells of the tubuli seminiferi, which are of epiblastic origin, it occurs at some period after puberty, and usually after middle age. Only one or two writers have attempted to establish examples of scirrhus of testis; this form of cancer may therefore be passed by without further consideration. Encephaloid

disease is the variety of carcinoma which attacks the testis, and it generalizes by the lymphatic system. It is hardly ever possible to make a differential diagnosis between sarcoma and carcinoma prior to operation. In both varieties there will be a tumor of more or less unequal consistence, and perhaps bossy outline. If the disease has attacked both testes, small round-celled sarcoma will be diagnosed; if cartilaginous masses be detected, spindle-celled sarcoma.

In the early stages of the disease, when, in the case of cancer of the testis, immediate extirpation is so imperatively demanded, it is often very difficult to make a diagnosis.

Hernia may usually be eliminated from the question by detecting the cord above the tumor; gummatous growths are rare in young, and tubercular growths rare in old subjects; and in distinguishing cancerous from syphilitic or tubercular growths, the history of the patient will guide the surgeon. Simple hydrocele may be readily excluded by its translucency; but it must never be forgotten that a slight hydrocele frequently coexists with cancerous and also with other affections of the testicle. Rheumatic gout and common chronic orchitis may generally be distinguished without difficulty; but the condition which is so commonly mistaken for cancer of the testis is a thick-walled hematocele. From this condition it is often utterly impossible to distinguish sarcoma of the testis, save by an exploratory puncture or incision. In any case where doubt exists, a free exploratory incision should be made through the scrotum and anterior layer of the tunica vaginalis. If the case prove to be one of hæmatocele, the coagulations should be removed, part of the cyst-wall excised, and the cavity drained: on the other hand, should the existence of malignant disease be demonstrated, the operation must be completed by castration.

For cancer of the testis early castration is the only treatment which can be recommended; but the rich lymphatic supply of vessels from the organ render infection of the iliac and lumbar glands probable at a very early period of the disease. Sometimes patients desire castration to rid them of the painful scrotal tumor, even when the lymphatic glands are obviously implied, and it is hopeless to perform castration with more than a palliative object. If the iliac glands be only slightly enlarged or suspected to be enlarged, I am not pre-

pared to say that attempts to procure the complete eradication of the disease should not be made by freely laying open the inguinal canal, and, having traced the lymphatic glands, to remove them wholly.

Cancer not infrequently occurs in a testicle retained within the abdominal cavity, or which has not descended lower than the inguinal canal. When a testis is lodged within the canal it is exceedingly liable to injury from accidents, or from compression by contraction of the abdominal muscles exerted upon it between the tendinous and bony structures of the inguinal canal. In any marked case of cancer of the incompletely descended testis there will be pain and, later on, absence of testicular sensation, and the swelling will soon commence to infiltrate the surrounding structures. In any case of doubt of malignant disease of the testicle, whether situate in its normal position in the scrotum, whether incompletely descended or retained within the abdominal cavity, let us earnestly recommend an exploratory operation.

CHAPTER VIII.

CANCER OF THE SKIN GENERALLY, AND OF SCARS.

THE cutis vera being developed from mesoblastic, and the epidermis with the superficial layers of the corium and the epidermic appendages being developed from epiblastic cells, it follows that both sarcoma and carcinoma may arise from the skin.

Sarcomatous growths are rare, but may arise from any part of the skin, the disease appearing as a more or less nodulated tumor, usually of round-celled type, though other varieties may be met with. Sarcoma usually occurs in connection with moles or warts, and its structure is pigmented, if pigment has existed in the tissue from which the malignant neoplasm has arisen. Although scirrhus of the skin is described by the older writers, as a primary growth it has usually been mistaken for epithelioma. The latter variety of malignant disease either occurs strictly according to the ordinary type, or as its sub-variety, rodent ulcer. Cicatricial cheloid (Alibert's) or lupus may occur—diseases which, though not epithelioma-tous or strictly malignant, simulate the malignant family in some respects very closely.

The most important group of cases of epithelioma of the skin are described in other chapters, viz., epithelioma occurring in certain sites where the skin merges into the mucous membrane at some natural orifice of the body or cleft upon the surface, such as the orifices of the mouth, nostrils, vagina, rectum, and margins of the eyelids. Epithelioma is also met with arising at the navel. The corrugations of the scrotum are pointed out as a favorite part of the skin for the development of cancer. Cancer rarely occurs upon the smooth, uninjured portions of the skin, but is found in connection with certain anomalous developments, such as warts or moles, and scars, whether of burns, scalds, wounds, or the cicatrized tis-

sue succeeding the lesions of syphilis, lupus, struma, and some other diseases.

Cancerous diseases of the skin are, from every point of view, of the greatest interest and importance. Their scientific interest lies in the circumstances that, situated on the surface of the body, their mode of origin and course are open to the direct observation of the surgeon, and in nearly every case some well-defined cause may be recognized, though in various cases the most different exciting causes will be found. Therefore a great deal is known to us about cancer which would not be known, but only matter of conjecture, had we to rely only for information on those cases of cancer which occur in internal organs. The practical importance of their early recognition and prompt extirpation is apparent when we consider how easily we can, in most cases of cancer originating in the skin, honestly affirm it to be a strictly local disease, and usually capable of permanent cure if only the patients will submit to operations which, perhaps extensive, or even sacrificial of some important part, are not dangerous to life. Further, from the knowledge we possess of the natural history of cancerous diseases of the skin, we are often in a position to say that some morbid condition, although not yet cancerous, will in all human probability shortly become so, and that the advent of malignancy may be prevented by extirpation of the tissue which is in the pre-cancerous stage.

I meant nothing more or less than this in 1887, when I objected to the teaching laid down by Sir James Paget in his Morton Lecture. Upon referring to the "Lancet,"[12] I find my letter concludes in the following manner:

"Finally, while disinclined to join issue with Sir James Paget upon every point, his statement that we have not yet found a method for either the prevention or the cure of cancer cannot be allowed to pass unchallenged, for instances in which the disease has been cured are familiar to most practitioners; and though there is no common method applicable for the prevention of all kinds of cancer, there are recognized principles to be adapted to many of its varieties. As example, let me cite the premonitory induration of the tongue or lips in elderly subjects, caused by irritation from the stumps of teeth or by smoking, which will often spontaneously resolve upon removal of the exciting cause. Leucoma or psoriasis of the

tongue, dependent upon local irritation coupled with syphilitic taint, may be resolved by antisyphilitic treatment sedulously carried out. Where cancer is presumed to be about to commence in the scrotum of a sweep, change of employment and cleanliness should be insisted upon and suitable local treatment employed. *Cessante causâ, cessat effectus.*"

In this letter I merely endeavored to remind those members of the profession (who might have been biased in the wrong direction by Sir James Paget) of the considerable portion of cases of cancer curable by early operation, or preventible; but Mr. Oliver Pemberton, of Birmingham, wished to argue the matter, and addressed a letter to the editors of the "Lancet," commencing in the following terms:

"SIRS:—Mr. Jennings, in your last number, commenting on Sir James Paget's Morton Lecture, says: 'Instances in which the disease [cancer] has been cured are familiar to most practitioners.' As I read Sir James Paget's conclusion, it is that in his vast experience he has never yet met with an instance of cure. During forty years, in an almost unlimited field for observation, it has never been my lot to see one. If Mr. Jennings or Mr. Clay will lay before the profession a solitary instance in which any case infiltrating the textures immediately around its origin, or contamination of the adjacent glands, has been cured by any mode of treatment—not excepting the use of the knife—a result will have been attained not hitherto acknowledged by pathologists. At present I am unable to regard the cases referred to and published by either of these gentlemen as being instances of cancer."

A short correspondence followed between Mr. Pemberton and myself in 1887, and I was rather at a loss to understand why he should have written letters so much against the weight of evidence and of reason; neither was I aware, at the time when Mr. Pemberton entered the arena on behalf of Sir James Paget—who, by the way, might be considered well able to take care of himself—that twenty years previously he had published a very admirable work entitled "Clinical Illustrations of Various Forms of Cancer, and of other Diseases likely to be mistaken for them, with Especial Reference to their Surgical Treatment." My readers will probably

be no less astonished than myself, upon perusing a few extracts from the excellent work of Mr. Pemberton, published in 1867, to hear him say, in 1887, that during forty years, in an almost unlimited field for observation, it has never fallen to his lot to see a solitary instance of cure. Let us see what Mr. Pemberton wrote in 1867:

"When, therefore, we consider the uncertainty of diagnosis which belongs to this disease, in the period when interference is most desirable, and that the treatment by complete excision may, in many cases, *effect a cure whether the case be of cancroid or of cancer* [italics mine], we are at a loss to account for the number of cases that present themselves in a hopeless state, attained not less by the apathy of the patient than by the indifference of the surgeon to an early interference."[13]

Again: "W. D., æt. 23, single, by occupation a sweep, was admitted under my care in the hospital, October 21st, 1861, on account of an ulceration seated in the scrotum.

"*History.*—Is a healthy-looking man, with unimpaired strength. Five years since he perceived a warty growth, situated at the upper and front part of the right division of the scrotum. This enlarged, but did not ulcerate for two years. . . .

"*Present State.*—Nearly the entire part of the scrotum is occupied by an irregular-shaped warty ulceration. The edges of this are hard and elevated. The sore itself is pale in color and destitute of granulations; and in the centre, over the situation of the right testis, it is deeply excavated. On the left side there is a little hardness and enlargement of the inguinal glands.

"October 26th.—Under chloroform I proceeded to remove the affected scrotum. Finding the ulceration had extended so as to be adherent at one spot to the right testicle, I removed this gland in the ordinary way, in addition, both on this account, but chiefly to obtain sufficient healthy skin, to cover the large surface of wound after the complete excision of the ulcerated surface. Indeed, without this additional proceeding it would have been impossible to have covered the wound.

"The patient made a good recovery, retarded by some slight suppuration in the right groin.

"In June, 1864, W. D. was at work in a colliery in good health, and without any return of the disease.

"January 19th, 1867.—W. D. was still at work at the colliery; he was without any return of the disease and in good health.

"In regard for the tendency of this disease [epithelial cancer of the scrotum] in its true form to recur after removal, my own experience leads me to the belief that it is very great. Immediately it does reappear in the site or neighborhood of the first growth, excision should again be carried out, and again and again as soon as it is surgically practicable.

"I repeat, an operation cannot be too early performed, so as to anticipate that deposit of cancerous elements which, sooner or later, takes place in these apparently otherwise simple formations. *The surgeon may then fairly promise his patient the certainty of relief, and even the probability of a cure*" [14] (italics mine).

Mr. Pemberton also adds a chapter on "Epithelial Growths following Moles and Warts," in which several cases of great interest are recorded. Among these may be noticed, first, that of a woman, M. H., æt. 45, who, in April, 1863, was the subject of an irregular-shaped ulceration which surrounded the seat of the mole on the forearm, measuring two inches in its largest diameter. The skin in the centre, an inch long, was entire, and that around the outside of the ulceration was elevated, dark-colored, and indurated. The surface of the ulcer was mostly clean and red, occasionally grayish in color. There were no glands enlarged. Mr. Pemberton, on April 29th, 1863, completely excised the affected part, including in his dissection the portion of skin containing the mole, as well as the ring of ulceration and a very free margin of the surrounding integuments, and passing deep enough to lay bare the muscles beneath. In June, 1867, when the case was reported, the patient remained well.

"The treatment necessary for these degenerated structures," adds Mr. Pemberton, "is free extirpation by the knife. I have seen the most lamentable results attend the use of caustics, and internal remedies can be of no service.

"Not only, where practicable, should a free breadth of skin be removed with the disease, but it is desirable also to take away a corresponding amount of the fascia beneath.

"The tendency will often be observed for the disease to recur in the cicatrix or near it. It should again be removed,

as the prospect of future immunity, in the absence of glandular affection, is found by observation to be by no means so unfavorable as might be expected from the recurrence. . . .

"When the disease is situated on an extremity, and is of such an extent as to justify amputation of the limb, this proceeding should be carried out within such distance from its seat as to secure the patient from the least probability of any of the local manifestation being left.

"I amputated the forearm in the following instance, where the appearance of the disease and the comparative rapidity of growth would have led me to anticipate scarcely so favorable a result as that which I now record."

Mr. Pemberton then narrates the case of a brewer, J. L., æt. 54, whose limb he amputated in the middle third of the forearm for a cancerous ulceration, chiefly confined to the entire dorsum of the index finger and the base of the middle one. It filled up the interval between the index finger and thumb, almost encircling the former. The disease had arisen from a wart which had been contused several times. Mr. Pemberton comments on this case:

"After a lapse of nearly nine years, this patient is without any return of his malady. Would a less complete proceeding have been attended by a similar result? The best answer to give to this question is to express very strongly my conviction that in these cases there can hardly be too vigorous a removal of disease. A mere excision of the affected parts, in the face of the confessedly doubtful degree of malignancy which many of these cases, in their earlier history, possess, cannot as a rule be successful.

"With this impression I do not hesitate myself to place before a patient the advisability of submitting to as early and complete an operation as practicable, more especially in those cases where the extremities are the localities affected.

"I believe that any considerable delay that hinders the treatment of the primary growth, when once it has become painful, or is increasing, adds greatly to the probability of speedy recurrence after removal. In the case of E. M., which follows, the wart-like growth was unchanged for five years, then for ten it was the seat of pain and slow increase. Within two months after removal it recurred in the cicatrix. The part was now amputated, but the glands became speedily

affected, the disease recurred in the limb, and the patient sank in a little over two years afterward."

The case of J. L., the brewer, first narrated, shows how, by prompt amputation through the forearm for cancer situated at the back of the hand and roots of the fingers, an immunity from recurrence of nine years was gained; and it would be interesting, now that a further interval of twenty years has passed away, if Mr. Pemberton would give us the further history of this case.

The case of E. M.,[15] which is next described, was one very similar in character to that of J. L., but unfortunately an early amputation was not performed in the first instance at a considerable distance above the growth, but an operation was performed just barely skirting the neoplasm, and not widely enough of the infected tissue around. In fact, the treatment (as demonstrated by the result) appears to be just as bad in the case of E. M. as it was good in that of J. L.

E. M., æt. 48 and a laundress, first attended the out-patient department of the hospital in Birmingham in February, 1861. Sixteen years previously she noticed a small wart-like growth, about the size of a pin's head, in the cleft between the second and ring fingers of the left hand After an interval of about five years, during which time the growth remained stationary, it began to grow and increase slowly in size up to Christmas, 1860, when it was of the size of a horse-bean, and had crept round so as to be situated on the palmar surface of the cleft. The investing skin remained quite sound until about a month before coming to the hospital, when she ran a hook in it, and the sore produced by this accident did not heal. In February the small tumor above described was manifest, into which an incision was made, but only blood escaped. The incision thus made did not heal, but assumed a typically epitheliomatous aspect. On April 3d the second finger was amputated, and the head and part of the shaft of the corresponding metacarpal bone were removed. The wound never healed completely, but in a few weeks the region soon reassumed an epitheliomatous appearance. On October 27th amptuation was performed through the forearm, and the stump healed; but in about two months' time the glands at the inner side of the elbow became enlarged, the epitheliomatous disease gradually disseminated, and the patient died January 8th, 1864.

The treatment of cutaneous cancer arising from warts is early extirpation of the malignant growth. It is only in a small proportion of cases, where the disease is of exceedingly small dimensions, and where some contra-indication against excision exists, that the disease should be treated by destruction by caustics. The caustic treatment sometimes yields satisfactory results in cases where the focus of disease is very small, but even in such cases the employment of caustics is only too often followed by recurrence upon recurrence, till finally the malignant growth has attained too considerable limits to be dealt with radically, or the internal organs have become implicated.

After excision of the affected skin and underlying tissues, repair of the gap may often be satisfactorily attained by skin-grafting; and, in connection with this subject, attention must be called to a recent communication to the "Lancet" [16] by Professor Esmarch, describing Wolfe's method of transplantation of skin-flaps. By this plan a flap of skin is excised from the arm or other suitable part, of rather larger area than the denuded gap which has resulted from the removal of the diseased tissues—in order to allow for slight subsequent shrinkage; and the skin-flap so obtained is merely secured by sutures in the chasm which it is desired to close. This is an advance upon the old operation of transplantation by leaving the flap adherent by a narrow tongue to its original site for a few days in order to maintain its nutrition. It is pointed out by Esmarch in his paper that the results of Wolfe's method leave little to be desired.

When the disease under consideration occurs upon a limb, the cases published in surgical literature go to show that early amputation, performed at some point well above the disease, is the only means by which immunity from recurrence may be relied upon. And there are few cases exceptional to this rule.

When epithelioma arises from cutaneous ulcers of long standing, a syphilitic origin of these ulcers may often be ascertained, especially if they be situated upon the lower extremity. Epithelioma, in most cases where it arises from tertiary syphilitic ulcers, may be attributable to a neglect in the treatment of the syphilitic disease by preparations of mercury and iodide of potassium.

Naturally, the transition stages of a syphilitic into an epitheliomatous ulcer are gradual, and in practice cases will be met with in the transition stage which correspond neither with the type of a syphilitic nor cancerous ulcer as described upon paper. In any case where the cancerous ulceration has become palpable by its typical physical signs, the practitioner must not omit to treat the constitutional syphilis present in the patient by medicaments, while he also treats the cancerous ulcer from a local and surgical standpoint. The principles of treatment of cancerous disease arising out of syphilitic lesions do not vary from those cases where this complication is absent.

Scar-tissue, from whatever cause arising, is prone to become the seat of cancer—especially when the cicatrix has resulted from a burn.

In Cashmir, where the natives are wont to burn themselves by sitting over hot braziers, epithelioma arising in the resulting cicatricial tissue is very common.

In this country, the cases of cancer arising in the scar-tissue which results from burns usually present well-recognized features.

In the first place, the disease develops out of scar-tissue of long standing, the patient often being past middle age, and the accident producing the burn having occurred in childhood.

Secondly, the disease commences as an ulceration of the scar-tissue in some part where the cicatrix is subjected to the greatest tension, especially in any part situated over some bony prominence and exceptionally liable to injury.

Thirdly, after a period varying from months to years the ulceration, which has shown little or no tendency to heal, assumes definite epitheliomatous characters. The edges of the ulcer will be hard, raised, everted, and of irregular outline; the marginal area being indurated and inflammatory. Nodulated granulations will be found growing from the ulcer, and the discharge will be fœtid, indicative of the rapid destruction of tissue, drying in small flakes or crusts, which may partly cover the ulcer.

Fourthly, in due course infection of the lymphatic glands will take place, and the disease disseminates in its ordinary manner.

Cancer of scar runs a very slow course, and the gland-

affection does not usually occur till after the disease has been established for many months or some years. Treatment either by caustics or by scraping the growths away with a curette and applying Pacquelin's cautery to the base is not a satisfactory form of treatment, the disease usually recurring exceedingly quickly after its incomplete destruction by these means. From the application of the cautery, too, a fresh cicatrix, of similar production (viz., that of burn) to the original cause of the disease, is established.

For cancer in burn-scar tissue occurring upon the limbs amputation is the recognized and proper treatment; treatment by caustics or scraping and cautery being measures which only temporize with the evil and especially inapplicable to cases in which the disease is extensive and situated in the region of a joint or over important vessels and nerves.

There can scarcely be any class of cases in which amputation is so imperatively called for as one in which the operation can be performed well above the site of this disease, with little risk to life, and in time to prevent dissemination through the lymphatic glands to the body.

"Especially . . . where amputation is necessitated by the degeneration of the wounds produced by burns, . . . the surgeon is justified in holding out a fair prospect that the disease may never recur," wrote Mr. Pemberton in 1867.[17]

Upon the very borderland of true malignant disease lies the cheloid of Alibert, which is a fibrous growth, sometimes containing spindle-cells occurring in scar-tissue. Cheloid only partially possesses malignant properties. It infiltrates the surrounding tissues, but only to a limited extent, appearing as a dense, bluish-white, smooth, elevated growth in the cicatrix. If excised, the cheloid invariably returns locally, but never infects glandular vessels or organs. The most striking peculiarity of cheloid, perhaps, is that, if in the case of a patient the subject of this disease a trifling incision be made in some other part of the skin, far away from the growth, a cheloid will appear in due course in the newly-formed cicatrix. Cheloid must therefore depend in measure upon some idiosyncrasy. Obviously, excision of simple cheloid growths must never be recommended. Physicians ordinarily recommend the application of collodion, or other means of repressing them mechanically. The plan of treatment which I have found most effica-

cious is destroying them by touching them here and there with the fine point of a Pacquelin's cautery, the surface having been previously painted with a solution of cocaine to prevent pain.

Epithelioma occasionally occurs in lupus-patches, either in aggravation of the lupoid disease or after its subsidence in the resulting scar-tissue. Dr. Bayla, of Tübingen, has collected forty-two cases of lupus-carcinoma, in one of which the disease commenced as early as the twenty-sixth year. Epithelioma occurring in conjunction with lupus, is ordinarily very malignant.

CHAPTER IX.

CANCER OF THE LIPS, NOSTRILS, EYELIDS, AND FACE.

THE lower lip is a common site for epithelioma in elderly males. Mr. Rogers Williams, in an excellent paper published in the "Medical Press and Circular,"[18] points out that neoplasms originate in the lips in 2.2 per cent of all cases—basing this calculation upon the records of 15,481 neoplasms. Of the 352 neoplasms commencing in the lips, of both sexes, only 12 originated in the upper lip; and of the 340 which commenced in the lower lip, 329 were epitheliomatous, all save three attacking the male sex.

Further, Mr. Williams has examined one hundred of the cases of epithelioma which occurred in the lower lip of the male, finding that the earliest age at which the disease appeared was 26 years, the latest 75.5 years, the mean age 52.4 years. It is also quite in accordance with common observation that in the male the lower lip is frequently affected with cancer during the sixth decenniad of life.

The comparative immunity from cancer in the lips which women enjoy, as contrasted with the frequency of its occurrence in the male, leads us to examine the different conditions of the lips in the two sexes. And in considering the etiology of cancer occurring upon external parts of the body, the antecedents of those parts, being readily open to inspection, lend considerable aid to the elucidation of the causes of cancer. Moreover, if investigations directed toward the causation of cancer occurring on some external and visible part of the body lead us to find that the disease has developed out of some palpable antecedent condition, it is not difficult to presume the etiology of many of the cancers arising in some internal organ, whose life-history yields evidence of conditions as likely to be precursors of malignant disease as those recognized upon the surface of the body. Now, the histories of cases of epithelioma of the lip leave three well-marked conditions standing

prominently forward as amply sufficient to explain almost every case of lip-cancer which falls under the notice of the practitioner, viz., smoking, syphilis, and jagged teeth; and in the small proportion of cases where cancer occurs upon the lips where all or any of these conditions may be absent, some other condition, acting locally upon the epithelium of the part and inciting it to proliferation, will be found.

We may dismiss from consideration the question of smoking in women, because so small a number of them are addicted to the habit. Mr. Williams has found that "of 26 cases in which inquiries were made as to smoking, etc., 16 had been great smokers and 8 moderate smokers; 5 of the smokers had chewed as well; 2 had never smoked or chewed." These figures tally very well with most surgeons' experience, and I am not overshooting the mark when I say 24 out of 26 cases (as found by Mr. Williams) of lip-cancer are caused by smoking; and thus we have at least one well-recognized cause of cancer, common to the male, who smokes, almost absent in the female, who hardly ever smokes; and not leaving open to us any room to seek for hereditary or other occult explanation of the occurrence of the disease.

In considering cancer of the breast we have noticed its rarity in the male, in whom the organ is so rudimentarily developed, and, on the other hand, its very frequent occurrence in the female organ, which undergoes such singular and periodical physiological changes. Therefore, from the localists' point of view, the different conditions of the lips and breasts in the opposite sexes, considered with the relative frequency of cancer, are serviceable to strengthen their position.

In regard to smoking as a cause of cancer, the habit operates in different ways—by the irritating effect of the smoke itself, varying in intensity with the kind of tobacco smoked, and by the direct mechanical irritation of the lip, by the cigar, cigarette, or pipe-stem. The most injurious of the various forms of smoking are the cigarette, the paper of which is apt to adhere to the lips, and the short, hot clay pipe commonly smoked by the lower classes. The common people who smoke clay pipes are usually too careless to coat the end of the stem evenly with sealing-wax, by which means the stem can be rendered as harmless as a smooth amber mouth-piece. Those who are the subjects of any chronic affection of the muco-

dermic juncture should certainly forego tobacco-smoking, particularly cigarette-smoking, unless the cigarettes are smoked through one of the many different kinds of mouth-pieces which do not stick to the lips. The saltpetre with which most of the cigarette papers are impregnated, to cause them to burn evenly with the tobacco, exerts unquestionably an irritating action upon the lip.

By far the larger proportion of cases of epitheliomatous disease of the lip originate on either the right or the left side, and it is ordinarily the sides of the lips which are brought in contact with the pipe-stem by smokers. The disease originates occasionally in the centre of the lower lip, and, still more rarely, at the angles of the mouth.

Little need be said of the causation of lip-cancer by jagged teeth, because this cause is sufficiently obvious hardly to require description. · Accumulations of tartar around the necks of the front teeth give rise to sufficient irritation to those parts of the lips or tongue with which they come in contact to incite the development of cancer in some cases.

As to syphilis, chronic secondary lesions on the lips are not infrequently the precursors of epithelioma. In the tertiary stage of syphilis a small gumma may appear on the lip, and its physical appearance may closely simulate epithelioma. But the gumma will resolve under syphilitic treatment, though it is important to note that if neglected gummata will sometimes become converted into epitheliomata.

The common form of epithelioma of the lips, the disease arising as a small nodule, lying beneath the muco-cutaneous margin in elderly subjects, and usually traceable to some recognized and adequate cause, presents little difficulty as to diagnosis, neither should there be any doubt as to the proper treatment in such a case. The growth, with a sufficiently wide area of the surrounding tissue of the lip, must be excised, leaving a V-shaped cleft whose edges are to be adapted with hare-lip pins.

One would imagine that there should be a unanimity of opinion on all simple cases of early epithelioma of the lip as to treatment by excision; but in practice such is not the case, and many practitioners still recommend (in our opinion, improperly) the use of caustics. Granted that in such early cases the growths can be destroyed by caustic pastes, yet by

these means sufficient of the healthy tissues around the growths cannot well be destroyed; while operations of excision must be considered as the most speedy and safe means of successfully eradicating the disease, and its recurrence need not be anticipated if the exciting cause or causes have also been removed, viz., by a course of antisyphilitic treatment, if there be any syphilitic taint; by abandonment of smoking; and by relegating the treatment of the teeth to a good dentist. Cases in which the disease has attained considerable proportions, either from neglect, improper treatment by caustics, or inadequate removal, are frequently presented to surgeons. It is difficult to say the precise limits which should negative, as being too far advanced for operations, radical measures; but nearly the whole of either the upper or lower lip may successfully be replaced by plastic operations.

Operations for cancer of the lip ought always to be undertaken before the lymphatic glands have become implicated. If the glands, however, be affected, they must be excised in the freest possible manner, and it is a good plan to ligature any large arterial trunks in the neighborhood at the time of the operation.

Epitheliomatous growths may appear upon parts of the face other than the lips, and they not infrequently are met with at the muco-cutaneous juncture of the nostril or eyelid; or, more rarely, from the skin of the cheeks. It is impossible to discuss the question of epitheliomatous ulceration of the face generally, apart from rodent ulcer and lupoid ulceration with which epithelioma is so often confounded. The essential distinctions between these diseases are as follows: The ulceration of lupus occurs usually in the young, and exhibits a tendency to heal spontaneously in some parts, while spreading in others. The margins of the nostrils are the most frequent site of exedent lupus, and the lymphatic glands are not affected. Epitheliomatous ulceration also occurs, as already mentioned, at the margin of the nostrils, but it is a disease attacking elderly people; the lymphatic glands in continuity with the primary disease become affected in due course, and there is no natural tendency to repair ever exhibited.

Rodent ulcer nearly always commences in the furrow between the side of the nose and the lower eyelid, where the sebaceous glands are peculiarly abundant; the lymphatic glands

are never affected, but the ulceration presents marked and distinctive physical signs, and usually appears in elderly subjects. The margins of the ulcer are sinuous, inverted, and rolled over; the discharge is very scanty, and the floor of the ulcer is florid, clean-looking, and rather glossy. Nevertheless the rodent ulcer, the epithelioma, and the lupoid ulcer present the pathological feature of new growth and ulceration co-existing; all are malignant, and therefore deserve mention in this connection. The treatment must depend upon the site of the growth. If the margins of the nostrils be implicated, the diseased portions should be thoroughly scraped away with curettes or spoons, and Pacquelin's cautery freely applied to the denuded structures.

A similar plan of treatment is to be recommended for rodent ulcer situated near the lower eyelid. But as the disease is certain to recur after some months or years unless its extirpation be really carried out effectually, considerations of disfigurement consequent upon the free extirpation of the rodent ulcer must yield to the fact that the parts can usually be restored to a great extent by carefully-planned plastic operations. In operating for epithelioma of the eyelid, surprisingly good results can often be obtained, even where the disease has attained considerable proportions. Very small-sized ulcerations on the face may sometimes be treated by the application of caustic paste; but as a rule it will be found better to resort to scraping them away or excising them, general or local anæsthesia having been induced.

CHAPTER X.

CANCER OF THE TONGUE.

THE tongue may be attacked by most of the varieties of cancer, though very rarely by any excepting epithelioma, the occurrence of which is exceedingly common. Epithelioma of the tongue occurs about five or six times more frequently in the male than in the female. It has been pointed out that cancer generally is more common in the female sex, but if we exclude the breast and uterus, then cancerous disease is more prevalent in the male, the predominance being due to the cases occurring in the tongue.

Epithelioma of the tongue may commence from any part of the surface of the organ, but most of the cases may be divided into two main groups: first, those commencing on the dorsal surface; and, secondly, those originating from one or other side or edge of the tongue.

When epithelioma arises from the dorsal surface of the tongue, it usually commences either solitarily in some small crack or fissure, or by multiple points from antecedent chronic inflammation, variously termed by different writers ichthyosis linguæ, psoriasis linguæ, leucoma or leucoplakia. All these, to which more might be added, are synonymous terms. Leucoma, or psoriasis of the tongue, must be regarded as the frequent precursor of cancer, and therefore its careful consideration becomes of the last importance. Exceedingly rare in the female, and rarely of idiopathic origin, psoriasis of the tongue is usually due to the syphilitic taint, but the condition is aggravated by, or perhaps sometimes solely caused by, smoking.

It commences generally in those past the meridian of life, in whom some foulness of the mouth exists from neglected teeth, errors in diet, the drinking of ardent spirits and liqueurs, and some rarer irritative conditions which have affected the mucous membrane. First, there is a localized hyperæmia, the papillary layer being denuded of its protecting epithelium.

Then the epithelium proliferates, and small white depressed patches, as if inlaid, may be noticed scattered here and there. A similar condition is frequently to be observed upon the lips or buccal mucous membrane. If patients apply for advice, as they rarely do in this early stage of the disease, a favorable prognosis may usually be given, but the gravity of the condition should at once be pointed out to the patient in the plainest possible manner. The teeth must be thoroughly put in order, smoking absolutely interdicted, the diet most carefully regulated; alcoholic beverages must, if allowed at all, only be permitted in a very diluted form and to a very small extent. Whether or no a history of syphilis be elicited, it is well to prescribe a mixture containing small doses of perchloride of mercury and iodide of potassium, with or without the addition of Fowler's solution. In some cases resolution of the ichthyotic patches may be attained in the most speedy manner by fumigating the tongue with vapor of calomel. Of the several apparatus in use for this purpose the best is that introduced by Dr. Hugh Fenton, which consists of a small iron retort into which a small teaspoonful of calomel is placed, and having been heated with a spirit-lamp flame beneath, the vapor is blown upon the tongue with a small india-rubber bellows attached to the instrument. By this means a fine metallic film of pure mercury is deposited upon the patches, which, in all except aggravated cases, resolve after a few fumigations.

Schuchardt has traced the steps between buccal and lingual psoriasis and cancer of the cheek and tongue.[19] A case fell under his observation where psoriasis of the tongue had existed for many years in a dormant condition, but ultimately assumed the character of epithelioma. The tongue having been removed, the transition from the psoriasis to the epithelioma was demonstrated microscopically. Schuchardt also draws attention to the development of cancer of the penis from "psoriasis preputialis," by which he means a condition of phimosis with chronic inflammation of the prepuce.

The lesson to be derived from these observations is that when a small isolated patch upon the membrane persists after the removal of all aggravating conditions and assumes a warty character, indurated around its base, the growth should be very freely excised by elliptical incisions. If the growth be of comparatively large size, say approaching the size of a nut, or

if the patches and growths, though smaller, be multiple, the entire tongue had better be excised; and in the case of operations performed in the premonitory or early stage of cancer, the removal of the tongue may be regarded as a curative measure. The loss of a tongue is to the patient not so great a sacrifice as at first sight would appear. The small part of the base close to the epiglottis and pillars of the fauces eventually falls forward and constitutes a miniature tongue. The faculty of speech, although impaired, still exists, and the patient will, in most instances, get on very comfortably with the diminutive organ.

When cancer occurs upon one or other side of the tongue, which is its most common site, there is not ordinarily much trouble as to the diagnosis. A small sore spot is usually first formed by the contact of the tongue with the inner surfaces of the molar and biscuspid teeth, with incrustations of tartar, faulty stoppings, or sharp edges. This soon becomes indurated around its base, the edges are typically rugged and everted, with a foul slough upon the surface of the ulcer, which bleeds very readily upon pressure. The chief difficulty in diagnosis lies in distinguishing the disease from a syphilitic gumma, which in the tertiary stage of syphilis not uncommonly develops in the tongue. A gumma usually occupies the central portion of the tongue, and the ulceration is secondary to the syphilitic growth. In the case of epithelioma, the side of the tongue is usually the part affected, the ulceration proceeds from the surface inward, and there is impaired mobility of the organ.

Partial removal of the tongue for cancer must not be recommended, save in exceedingly early stages of the disease.

I recollect the case of a woman whom I treated at the Cancer Hospital and who first presented herself to me with an ulcerated epithelioma about the size of a sixpence on the left lateral border of the tongue. The disease appeared so small and isolable that I thought I could certainly save the tongue. I ligatured the left lingual artery beneath the hyoglossus muscle, and afterward excised the growth with a good wedge-shaped portion of the adjoining lingual tissue. There did not appear to be the smallest trace of glandular affection. The tongue got perfectly well within a few days, and the immediate result was excellent; but recurrence of the disease

took place in the floor of the mouth in a few weeks. The fact must never be forgotten, in considering cancerous disease of the tongue, that both the vascular and lymphatic systems of the organ are exceedingly ample, and favor the growth and progression of cancer to an extent almost unparalleled in any other region of the body. Hence in treating epithelioma of the tongue—the question of syphilis having been excluded by the history of the case, an absence of its physical signs, or by the negative results of antisyphilitic remedies boldly pushed—if an operation is to be resorted to, nothing short of extirpation of the whole tongue and a considerable part of the floor of the mouth, with the adjacent lymphatic vessels and glands, should be contemplated. Such an operation is certainly severe, but need not be considered as dangerous to life in a case suitably selected, proper care having been given to operative details and proper antiseptic dressings selected.

There are, perhaps, more methods of excising the tongue than for the performance of almost any other operation in surgery.

By Kocher's method a more thorough extirpation of the infected parts beneath the base of the organ and in the submaxillary space can be effected than by the other operations; and it, or some modification of it, should be selected for most of those cases of cancer where the side of the tongue and floor of the mouth are infected. In no situation can the effects of cancerous disease be more horrible from every point of view than when the tongue or mouth are implicated, and upon these grounds extirpation of the malignant growth is often recommended merely as a palliative measure, to mitigate distress, prolong life, check hemorrhage, and remove the fœtor which attends the disease. When the bleeding from a cancerous tongue becomes profuse, ligature of the lingual artery is often necessary for its arrest. The secondary growths, too, often give rise to alarming hemorrhage by ulcerating into some of the large vessels in the submaxillary or anterior triangles; in these cases, also, the ligature of the artery involved or of the common carotid is often advisable.

For dyspnœa, caused by pressure of the growths upon the trachea, tracheotomy must be performed, and this operation may become necessary while excision of the tongue is being carried out.

In all cases of cancer of the tongue where operative proceedings are discountenanced Chian turpentine should be administered. The value of this drug for uterine cancer has been pointed out, and the same principles guide its administration for lingual cancer.

The various mouth-washes prescribed to diminish or destroy the fœtor of the discharge in malignant disease are too well known to need description. Where dysphagia exists, the propriety of performing gastrostomy should become the subject of consultation.

Malignant disease may also occur primarily in the lymphatic glands or salivary glands in the floor of the mouth. In any case the disease must be recognized by its physical signs, and distinguished from non-malignant tumors, such as ranula, nævi, and simple adenomata.

Calculi imbedded in the salivary ducts, abscesses, and enlargements of the bursa sublingualis submucosa can hardly be mistaken for cancer.

CHAPTER XI.

CANCER OF THE NOSE, NASO-PHARYNX, PALATE, GUMS, AND TONSILS.

The cavities of the nose and naso-pharynx are sometimes the seat of malignant disease. Carcinomatous growths, encephaloid, and epithelioma are exceedingly rare, especially the latter, in these situations.

Epitheliomatous ulceration, when commencing in the interior of the nose, is difficult of recognition in its early stages, unless situated in the anterior portion of the nasal chamber. From necrosis of the nasal bones, due to syphilis, struma, lupus, and injuries, the disease has to be distinguished.

A sarcomatous growth of the nose and naso-pharynx appears, ordinarily, in the form of a solitary polypus, of a purely sarcomatous or fibro-sarcomatous composition. In the nose, the growth usually springs from the septum, less frequently from the floor or outer walls of the cavity, and is distinguishable from simple non-malignant polypi by being solitary, of a tough consistence, non-hygrometric, and by its readily hemorrhagic qualities.

When a malignant polypus is found in the naso-pharynx, it is usually attached to and arises from the roof of the cavity, or the under surface of the base of the skull. The polypus may be of encephaloid nature, but is more frequently of the sarcomatous type.

A malignant polypus arising in either the nose or naso-pharynx by its growth encroaches upon the neighboring parts, causing prominences on the maxillary region of the face by extension forward, on the palate by extension downward, or protrusions of the eyeballs by extension upward, giving rise to the condition known as frog's face. If the growth be situated in the naso-pharynx, it can be recognized by the finger inserted through the mouth, or may be seen protruding below the inferior border of the velum pendulum palati. Naso-

pharyngeal polypus ought to be easily distinguished from retro-pharyngeal abscess, with which it has been confounded; but polypus in this region has not infrequently been mistaken for an encephalocele, bulging through the base of the skull, and the deplorable result of treatment based upon a mistaken diagnosis need scarcely be commented upon.

As to treatment for malignant disease arising in the nose or naso-pharynx, preliminary exploratory operations are needed to gain free access to the disease. These are various, and the particular exploratory operation must be selected by which the readiest access can be gained to the base of the growth:

1. The anterior portion of the nasal cavity may be opened either by an incision carried through the median line of the nose and upper lip, or by one commenced below the inner canthus of the eyelids and passing downward in the naso-maxillary groove, around the cartilage of the aperture of the nose, terminated vertically through the median line of the upper lip.

2. Access having been gained by the latter incision to the front of the nasal chamber, its deeper portions may be exposed more fully by chiselling through the inferior maxillary bones (their soft covering having been reflected outward), horizontally, in a plane above the level of the palate, and by afterward forcibly depressing the anterior palatine portion downward, but leaving the posterior and soft portion of the palate with its vessels and nerves undisturbed. The parts can be reunited after the object of the exploratory operation has been accomplished.

3. Rouge's excellent operation, which consists in dividing the labio-gingival mucous membrane horizontally, from the left upper to the right upper molar teeth, by gaining access to the front of the nasal cavity over the anterior nasal spine, and reflecting the soft parts and nasal cartilages upward over the face.

4. Exploratory incisions through the palate.

After the growth has been sufficiently exposed by the exploratory operation which has been selected, it must be severed from its attachments by burning through its pedicle with Pacquelin's cautery or with a galvanic-wire cautery. In some cases the neoplasm may be excised with scissors, a scalpel, or by chiselling it away, but the hemorrhage consequent upon such procedures is often alarming and difficult to arrest.

During operations of any extent of the character referred to, there is always a certain danger contingent upon the passage of blood into the lungs through the trachea. Some writers advise either that tracheotomy should be performed, and Trendelenburg's tampon canula inserted into the trachea, or an ordinary canula employed, a sponge with a long thread attached being pushed into the pharynx. In most cases, in the hands of skilful operators, these preliminaries may be dispensed with; but the operator should always be prepared to perform tracheotomy, or to infuse saline fluid into the veins in case of need, and he must be considered lacking in common care should he neglect to have the proper instruments for these operations at hand, as the patient's life may hinge upon the prompt performance of one or other of these procedures.

Cancer occurring primarily in the palate is rare; but it is sometimes met with in the form of epithelioma, or still more rarely as sarcoma. Epithelioma of the palate does not present appearances different from the growth as found elsewhere. Sarcoma appears as a prominent, vascular, semi-fluctuating swelling beneath the periosteum, which might be mistaken in some cases for an abscess.

Save in cases where the malignant disease has advanced too far, the palate should be excised for cancer. This operation is far simpler than at first sight appears. One of the central incisor teeth must be extracted, and the alveolar margin sawn through almost in the middle line. The incision must be extended through the middle line of the hard palate from before backward, by means of a narrow saw inserted over the anterior nasal spine into the inferior meatus. An incision through the labio-gingival furrow is then made as in Rouge's operation, and each half of the palate successively removed by chiselling through the maxilla, horizontally, a little above the level of the palatine process. The process must then be wrenched away from its posterior bony attachment, the velum being cut through with scissors, and the posterior palatine vessels grasped with Wells' pressure-forceps, or touched with the point of the platinum cautery.

Malignant epulis is the term applied to sarcomatous or epitheliomatous growths, springing from the periosteal margin of the alveoli. In all except very extensive cases they should be excised with a considerable width of the bone from which they spring.

Butlin [20] records twelve cases of primary cancer of the tonsil, in all of which microscopic examinations of the growths were made. Nine were cases of small round-celled sarcoma, one of spheroidal-celled carcinoma, and two of epithelioma. In all save one of the cases of sarcoma there were secondary deposits in the glands. In the exceptional case the tonsil was removed by the thermo-cautery knife, and two years afterward the patient was quite well and free of the disease. Of the other cases, two of which were operated upon with the galvano-cautery, three with the écraseur, and the remainder by excision with the knife, all proved fatal by recurrence of the disease, though all recovered from the immediate effects of the operations and were temporarily relieved.

CHAPTER XII.

CANCER OF THE BONES.

THE bones with their periosteum and vessels, being derived from mesoblastic tissue, cannot give rise primarily to malignant growths other than sarcomata. An apparent exception exists in the case of the upper jaw, the interior of the antrum being clothed with mucous membrane continuous with that of the nasal fossæ, and encephaloid carcinoma may arise from the glands of this mucous membrane. The older writers used ordinarily to treat of cancer, meaning carcinoma of bone, but, for reasons already given, when cancer occurs in bone it is as some form of sarcoma.

As distinguished by the characters of its component cells, sarcoma of bone appears either as small round-celled, spindle-celled, mixed-celled, or giant-celled (myeloid). Moreover, the sarcomata of bone are divided into two main groups, viz., those which arise from the interior of the bone, usually in the case of a long bone commencing in the cancellous tissue of an epiphysis, and termed "central" growths; and a group which arises from the periosteum, and termed "periosteal" growths.

The periosteal growths, again, occasionally arise from the outer surface of the membrane, such tumors being designated "parosteal," but far more frequently they spring from its inner surface, "subperiosteal." Practically, however, the parosteal growths may be dismissed from general consideration, and excluding, further, malignant disease of the upper jaw, cancer of bone may be arranged either as subperiosteal or central sarcomata. This difference of origin is of the greatest importance to appreciate, because it carries with it other marked differences as to structure, diagnosis, prognosis, and treatment.

As to structure, an example of either growth may consist of round, spindle, or mixed cells, or of myeloid cells sparsely scattered; but myeloid cells are never present in large pro-

portion in subperiosteal sarcoma, while in growths of central origin, four-fifths of their bulk may be constituted by myeloid or giant cells. Further, when myeloid cells exist in abundance in a sarcoma, they impart to it a maroon-red coloration, and thus by the naked eye the myeloid may be distinguished from the sarcoma whose cells are round or spindle-shaped, and which give a paler color to the neoplasm.

Secondary changes are rare in the central sarcomata, but ossification and chondrification are common in subperiosteal growths. The central growths are more or less confined by the bony walls surrounding them, which retard their rate of progress, reducing their malignancy; but as a growth advances toward the surface the bone thins away before it, and when the bony layer has been reduced to the thickness of parchment or egg-shell, a peculiar crackling, which aids the recognition of the disease, can be elicited upon manipulation. The vascular supply, too, is more liberal toward the central than the subperiosteal growths, whence the pulsation, absent in the latter variety, is often met with in the former. The tendency to glandular implication and infiltration of the surrounding structures is less in the case of central than of periosteal growths; nor are secondary growths nearly so common in internal organs in conjunction with the former as with the latter variety.

From all these considerations it appears that ordinarily the prognosis is favorable in a case of central, but bad in one of subperiosteal sarcoma. For subperiosteal sarcoma of the extremities, very early amputation is the only surgical means upon which any hope of cure can be placed; but some surgeons incline to think that for the central variety of sarcoma, removal of the disease with resection of portion of the bone in which it lies will be adequate. To my mind, it appears that, while admitting the far less probability of generalization in the latter than in the former case, there can be few instances where anything short of amputation can be considered sufficiently radical to extirpate the disease.

When sarcoma attacks, centrally, one of the bones of the vault of the skull, the growth is usually solitary, and not prone to infect the lymphatic system. Subperiosteal (subpericranial) disease, on the other hand, usually consists of multiple growths, which are very apt to generalize rapidly.

A subpericranial sarcoma needs to be distinguished from a node, whether simple or syphilitic, from hæmatoma, and from Pott's "puffy tumor." The probability of other growths appearing shortly does not offer much hope of advantage to accrue from excision of a subpericranial sarcoma; nor must the further consideration be forgotten of the possible existence of a similar growth on the converse side of the bone. When sarcoma arises in connection with the dura mater, the growth usually first invades and afterward perforates the calvarium as a fungating mass, which pulsates either on account of the size of its own vessels, or pseudo-pulsation may be transmitted from the brain beneath. Such a sarcoma is termed by the older writers "fungous tumor of the dura mater."

Sarcomatous disease of the bones not infrequently appears in conjunction with osteitis deformans.

Cancer of the upper jaw may occur either as sarcoma springing from the bone itself and its investments, or as encephaloid carcinoma commencing in the mucous lining of the nose or antrum. Tumors of the upper jaw may be either innocent or malignant, or cystic or solid. Both innocent and malignant tumor may also spring from the surface of the bone in front, arise from the interior of the bone, or press it forward by expansion from behind. If the tumor be malignant, and situated either superficially, or, if deeply, with room to expand into the nasal fossæ or pharynx, its rate of growth will be rapid, and the lymphatic glands will become affected early. Its tendency to rapidly infiltrate the surrounding tissues and the irregularity of its contour (before it may have advanced to the ulcerative stage) will serve to distinguish it from an innocent tumor. The sensation of egg-shell crackling, in any case, cannot by itself be regarded as distinctive of malignant disease, but ordinarily merely of a growth, innocent or otherwise, coated by a thin bony layer.

The early recognition of malignant disease of the upper jaw is often as difficult as it is important, and often cannot be made apart from exploratory puncture or incision. Fortunately these means are indicated in the treatment of the non-malignant tumors. An exploratory puncture will demonstrate the existence of dropsy of the antrum, of chronic suppuration within the antrum, or aid the diagnosis of a dentigerous cyst, if doubt remain as to whether the tumor under examination

be one of these conditions or of a soft cystic sarcoma. For every form of malignant disease of the upper jaw, before glandular infection has arisen, excision of the bone should be performed. Considered *per se*, excision of the bulk of the upper jaw, as ordinarily performed, through an incision carried down the side of the nose, and through the median line of the upper lip, with a short auxiliary incision running below the lower margin of the orbit, need not be deemed of a dangerous character; and if the malignant growth, on account of which the operation is performed, be small, and especially if centrally situated, an exceedingly good result may be anticipated.

On the other hand, if a case be presented to an operator where the submaxillary lymphatic glands are affected, where the growth has infiltrated the soft coverings of the face, or has ulcerated into the mouth and nose, the only good to be anticipated from excision of the jaw would be the temporary removal of a source of the greatest distress to the patient, but with the risks of a dangerous operation.

Sarcoma attacks the lower jaw in forms which may arise either from the periosteum or from the medullary portion. The same principles of treatment apply both to sarcoma of the lower and upper jaws. In the case of the lower jaw the central are commoner than the subperiosteal variety.

Subperiosteal are commoner than central tumors of the clavicle, though this bone is but rarely attacked by malignant disease. The only objection to resection of the clavicle for malignant disease is the important anatomical relationship of the bone to the structures beneath it. Still, in well-selected cases resection of the clavicle may be advantageously resorted to, especially for sarcoma attacking the outer extremity of the bone.

Sarcoma of the scapula is not a very uncommon variety of malignant disease. It ordinarily occurs about the age of puberty, and a typical case is described in the "British Medical Journal" of July 10th, 1886. The patient was aged sixteen, and admitted in July, 1883, into University College Hospital, under the care of Mr. Heath. The natural outlines of the right shoulder were obscured by a roughly pyramidal swelling, the base of which was situated at the axillary border of the scapula, and the apex at about the middle of the supra-condylar

ridges of the humerus. Amputation had been proposed six months previously, but had been then declined. On July 4th, 1883, Mr. Heath amputated the arm at the shoulder-joint, and excised the scapula and outer portion of the clavicle. From this operation the patient recovered, and remained free from recurrence of the disease, which was of an exceptionally aggravated form, till Christmas, 1885, when a small lump was observed on the front of the chest. In May, 1886, this growth measured three inches in diameter, and it was excised. The patient recovered quickly, and no further signs of recurrence were observed when the case was reported in July, 1886.

When the humerus becomes the seat of sarcoma, either the growth appears in the head of the bone as a central neoplasm, or the shaft is the situation of a subperiosteal growth.

When the head of the humerus is attacked, the growth tends in its early stage to expand the bone in a direction outward. The expanded extremity of bone is also uneven in contour, and in due course there will be egg-shell crackling. The neoplasm does not invade the articular cartilages; if very vascular there will be a bruit and pulsation somewhat simulating aneurism of the axillary artery. But the firmer consistence of the tumor, its position, the absence of bilateral expansatility, and the fact that its dimensions are not lessened by compression of the subclavian artery, serve to establish the differential diagnosis. Enchondromata and exostoses are prone to occur at the upper epiphysial line on the humerus, but such growths are denser and more pedunculated than central sarcoma. As to treatment, some recommend excision of the head of the humerus, and this might suffice if the diagnosis were established at a remarkably early period; but in most cases amputation at the shoulder-joint will be the proper operation, and it may be advisable even to extend the area of the operation, as in Mr. Heath's case.

Subperiosteal sarcoma of the humerus appears as a swelling over some part of the shaft of the bone, producing a somewhat spindle-shaped aspect. The disease is certainly apt to be confounded with periostitis, but any doubt can be cleared up by an exploratory incision. Bearing in mind that the smaller the tumor, *cæteris paribus*, the greater the difficulty of diagnosis, but, if detected, the more hopeful the treatment, the importance of exploring any doubtful growth in the region

of the humerus will be apparent. Subperiosteal sarcoma of the humerus is a very malignant from of cancer, and in most cases amputation at the shoulder-joint is to be recommended.

Central sarcoma of the lower extremity of the humerus is rare. Subperiosteal sarcoma attacks the shafts of the radius and ulna, and central sarcoma the extremities (usually the inferior) of these bones. Being situated further from the trunk than the humerus, the prognosis is far more hopeful; and the same general principles already laid down must be applied to any tumor of the radius or ulna in respect to diagnosis and treatment.

Sarcoma may also attack a metacarpal bone or phalanx, subperiosteally or centrally, but the disease is rare.

The sternum and the ribs are occasionally the seat of sarcoma. If the growth be detected while small, it may often be successfully removed with the portion of bone from which it springs.

The femur is the most liable of all the long bones to sarcomatous disease. Subperiosteal sarcoma may be either round, spindle, or mixed celled, and is usually situated over the lower portion of the bone. Subperiosteal sarcoma of the femur is a most fatal variety of cancer, and has been known to run its course from start to finish within three months. The probability that amputation above the disease, through the shaft of the femur, will not be a safeguard against recurrence, and the great danger to life which accompanies amputation through the hip-joint, render subperiosteal sarcoma of the femur one of the most unfavorable kinds of cases which falls under the notice of the surgeon.

Latterly a new method of amputation at the hip-joint has been introduced, viz., by a lateral vertical incision terminating in an oval, after the oval method of amputation at the shoulder-joint. The vessels can be secured as they are divided by this method, and the results will probably yield a far larger number of successes than those afforded by flap operation. The patient is placed upon the sound side, and the sound thigh fully flexed and secured in that position. A vertical incision is commenced about two inches above the trochanter, and carried downward along the femur for several inches. The operator dislocates the head of the femur from the cotyloid cavity, his assistants first abducting and afterward adducting

the limb. While the limb is fully adducted and the upper part of the femur forcibly pulled out of the wound, the knife must be glided down the inner side of the bone, separating the muscular attachments to as low a point as necessary. Amputation is concluded by cutting across the soft parts, the femoral artery having been previously secured.

Central sarcoma usually selects the lower in preference to the upper extremity of the femur.

The tibia and fibula are often the seats of subperiosteal or central sarcoma. The subperiosteal form, when it attacks these bones, often fungates through the skin, a complication only very rarely met with in the case of the femoral sarcoma. The upper extremities of the tibia and fibula are those in which central sarcomata usually occur.

Sarcoma of these bones is, as compared with femoral sarcoma, a much slower-growing form of cancer.

The same general principles apply to sarcoma of the lower extremity with regard to resection and amputation as for the upper extremity—with the reservation that of amputations of the upper as compared with the lower extremity, the danger to life is greater in respect to the lower limb. As to the risks of amputations of the extremities, in reference to their position upon the limbs, the general rule is that the nearer the amputation is performed to the trunk, the greater the danger.

Of course the mortality of amputations depends more upon the various conditions which surround the case than upon the exact site of the amputation, and the general mortality of amputations has been enormously diminished during late years by the introduction of antiseptic surgery, improved means of controlling hemorrhage during operations, as well as improvements in the administration of anæsthetic agents and other matters of detail.

Neither can any hard and fast line be drawn upon the limb below which amputation must be considered safe and above which dangerous. In the lower extremity, the risks of the operation must certainly be considered to increase from the knee-joint upward. Anatomically, the hip-joint corresponds to the shoulder-joint, and the knee to the elbow, as contrasting the extremities; but surgically, and in respect to the comparative

risk of amputation, the knee-joint must be considered as more or less corresponding with the shoulder-joint.

A very valuable contribution, demonstrating how the risks of operative surgery have diminished in modern times and are still diminishing, will be found in the "British Medical Journal" for January 28th, 1888, written by the pen of Mr. Dunnett Spanton, of the North Staffordshire Infirmary. He records the results of major operations performed in his infirmary from 1854 to 1887. The tables include the various amputations of the extremities and excisions of the joints; excisions of the breast, testis, penis, tongue; lithotomies, osteotomies, and other major operations.

The final results of all these operatons at the North Staffordshire Infirmary come out as follows: From 1854 to 1858, 95 operations are reported, with a mortality of 14.73 per cent; from 1859 to 1863, 119 operations, with a mortality of 16.8 per cent; from 1870 to 1874, 136 operations, with a mortality of 17.65 per cent; from 1879 to 1881, 263 operations, with a mortality reduced to 6.08 per cent; and from 1885 to 1887, 161 operations were performed with only a mortaltiy of 2.42 per cent. A considerable number of the amputations were performed for compound comminuted fractures of the bones, and it is well known that the mortality sequent to amputations for injury is greater than that sequent to amputations for disease. This latter point is well shown by Mr. Frederick Page, who has specially investigated the causes of amputation-mortality at the Newcastle Infirmary.

I conclude this chapter by adding the last contribution on this subject, as supplied to me by the courtesy of Mr. Page, because I think it deals very practically with the question of amputation-mortality, and supports my contention that if operation cases are properly selected, and the patients are carefully looked after and surrounded with proper precautions, both during the operation and during the after-treatment, operations of very considerable magnitude may be undertaken with every prospect of recovery.

Results of Major Amputations treated antiseptically in the Royal Infirmary, Newcastle-upon-Tyne, during the last ten years and nine months.

By FREDERICK PAGE, Honorary Surgeon to the Royal Infirmary; Examiner on Clinical Surgery in the Universities of Edinburgh and Durham.

The following table gives the result of major amputations treated antispetically in the Royal Infirmary, Newcastle-upon-Tyne, during the year 1888:

TABLE I.

Table of Major Amputations treated antiseptically in the Royal Infirmary, Newcastle-upon-Tyne, during the year 1888.

	INJURY.			DISEASE.			TOTAL.
	NO.	R.	D.	NO.	R.	D.	
Double amputations	..	..	..	..	..	..	..
Hip joint	1	..	1	..	..	..	1
Thigh	1	1	..	10	10	..	11
Knee joint	..	..	..	..	..	..	..
Leg	4	1	3	2	2	..	6
Ankle joint	1	1	..	13	13	..	14
Shoulder joint	2	1	1	1	1	..	3
Arm	2	1	1	..	..	..	2
Forearm	2	2	..	3	3	..	5
Wrist	..	..	..	..	..	..	..
	13	7	6	29	29	..	42

The number of amputations is unusually small and the mortality unusually high. Of the 42 patients treated, 6 died =14.2 per cent. Twenty-nine of the operations were for disease, and among these there were no deaths. Last year we had 43 amputations for disease without a death, so that we have now had 72 consecutive amputations for disease without a single death. Of the 13 amputations for injury, 6 patients died, which is a mortality of 46.1 per cent, contrasting very unfavorably with the mortality following amputation for injury during the five previous years. From January 1st, 1883, to December 31st, 1887, exactly 100 major amputations were performed for injury, and four patients died.

The mere statement, however, that so many cases have been operated upon, and that so many proved fatal, is not of much value as a criterion of success or otherwise, unless details are given of each death, and it is with the view of mak-

ing these statistical records valuable that I have now for a term of six years carefully tabulated the circumstances accompanying each death, the actual cause of death, and the age of the patient. We want, in an inquiry of this kind, to know particularly how many patients have died from blood-poisoning. That is the crucial question. Blood-poisoning is to a considerable extent an avoidable cause of death. The age of the patient is a matter of great importance—determining, as it does, more perhaps than any other single circumstance, the result of the case. We have been wonderfully free from deaths from blood-poisoning. During the five years preceding the past year only two cases occurred; but the following history of the six deaths in 1888 is less satisfactory than any preceding record.

Precise Cause of Each Death in the Year 1888.

1. Man, aged 49 years, amputation of the leg five months after compound fracture; stump very nearly healed; death from blood-poisoning. The blood-poisoning is supposed to have been due to the man spending several hours smoking in a water-closet.

2. Man, aged 44 years, upper arm crushed off close to shoulder-joint by wheel of a locomotive. It was difficult to cover the wound with skin after dis-articulation; sloughing took place; death from blood-poisoning.

3. Man, aged 49 years, primary amputation of leg below the knee for compound fracture; part of the foot of the other limb was removed at same time; death in 14 days from blood-poisoning.

4. Boy, aged 14 years, primary amputation at the hip; death in a few hours from shock.

5. Boy, aged 15 years, admitted from a distance with gangrene of foot, following compound dislocation of ankle-joint received a week before; death from tetanus six days after amputation below the knee.

6. Woman, aged 62 years, primary amputation of right upper arm for compound fracture. In addition there was a very extensive laceration of the soft parts of the left leg and thigh. The amputation remained sweet and progressed favorably, but the lacerated wound of the lower extremity became

septic, and patient died from blood-poisoning 14 days after the accident.

It will be seen that of the six deaths four are returned as due to blood-poisoning. Two of these four patients were 49, one 62, and one 44 years of age. The other two were boys—one, aged 14 years, died soon after primary amputation at the hip, from shock; the other, aged 15 years, from tetanus, which is regarded as a form of blood-poisoning by some eminent authorities. I do not think it wise to look upon these deaths from blood-poisoning as accidental; and I feel they should stimulate us to most diligently search out and exclude every possible source of infection. I am perfectly satisfied that years ago the high amputation-mortality in this hospital was due, to a large extent, to the circumstance that the surgical cases were dressed by the same persons who made the post-mortem examinations. I feel very strongly that the house-surgeons and the dressers ought not to be permitted to enter the post-mortem theatre or to frequent the dissecting-room during their tenure of office. There is risk, to my mind grave risk, of infection being brought from those places, and it is an avoidable risk to which patients need not and should not be exposed.

The following table gives the results of amputations during the last six years—during the time that the precise cause of each death has been recorded:

TABLE II.

Table of Major Amputations treated antiseptically in the Royal Infirmary, Newcastle-upon-Tyne, from January 1st, 1883, to December 31st, 1888—a period of six years.

	Injury.			Disease.			Total.
	NO.	R.	D.	NO.	R.	D.	
Double amputations	2	1	1	..	..	..	2
Hip joint	1	..	1	10	7	3	11
Thigh	16	14	2	79	76	3	95
Knee joint	4	4	..	1	1	..	5
Leg	27	24	3	35	33	2	62
Ankle joint	15	15	..	53	52	1	68
Shoulder joint	5	4	1	7	7	..	12
Arm	18	17	1	11	10	1	29
Forearm	18	17	1	15	15	..	33
Wrist	7	7	..	..	.	..	7
	113	103	10	211	201	10	324

Here we have 324 major amputations with 20 deaths = 6.1 per cent; 113 amputations for injury with 10 deaths = 8.8 per cent; 211 for disease with 10 deaths also = 4.7 per cent.

If we add the above table to one already published, giving the results of amputation from April 1st, 1878, to December 31st, 1882, we get the following results for the period of ten years and nine months.

TABLE III.

Table of Major Amputations treated antiseptically in the Royal Infirmary, Newcastle-upon-Tyne, from April 1st, 1878, to December 31st, 1888, a period of ten years and nine months.

	Injury.			Disease.			Total.
	NO.	R.	D.	NO.	R.	D.	
Double amputations.....	2	1	1	..	..	..	2
Hip joint.....	1	..	1	12	7	5	13
Thigh	32	25	7	116	110	6	148
Knee joint.....	7	6	1	5	5	..	12
Leg.....	47	40	7	59	57	2	106
Ankle joint.....	19	19	..	69	68	1	88
Shoulder joint.....	8	7	1	9	9	..	17
Arm	29	26	3	17	16	1	46
Forearm.....	26	25	1	19	19	..	45
Wrist.....	7	7	..	..	..	..	7
	178	156	22	306	291	15	484

Four hundred and eighty-four cases with 37 deaths = 7.6 per cent. Of these amputations, 178 were for injury, and 22 patients died = 12.3 per cent; 306 were for disease, and 15 patients died = 4.9 per cent.

CHAPTER XIII.

CANCER OF THE GULLET, LARYNX, LUNGS, AND HEART.

WHEN the gullet is attacked by malignant disease it is nearly always by epithelioma, though occasionally by sarcoma, and sometimes by encephaloid, colloid, and scirrhus; but examples of the latter varieties are so rare that they may be dismissed from general consideration. The most usual spot for the commencement of epithelioma of the gullet is the posterior surface of the larynx; and as some anatomists assign this particular region to the lower part of the fauces rather than to the beginning of the œsophagus, a considerable number of the cases of cancer of the gullet are thus erroneously excluded from statistical tables. Nevertheless, if we include this region, considerably more than a third of all cases of œsophageal cancer must be assigned to the upper third of the tube, and most of the remaining cases may be divided as to origin between the spot where the middle third terminates in the lower third and where the lower third perforates the diaphragm. Of course some cases of epithelioma originate from intermediate parts of the œsophagus.

The male sex is attacked by cancer in the gullet about twice as frequently as the female sex. In many cases the immediate exciting cause of the disease cannot be recognized, though probably all may be presumed to arise from some antecedent chronic inflammation. How varied are the causes which produce injury of the mucosa of the œsophagus are familiar to all students and practitioners. The imbibition of ardent spirits, liqueurs, and other alcoholic beverages; very hot tea, coffee, or soup; the swallowing of unduly large morsels of food, of fish-bones, and other substances which may mechanically injure the passage; syphilitic and sometimes tubercular lesions, include the most common causes of cancer in this region. When the disease commences in the upper orifice of the œsophagus, it may be recognized by examination

with the mirror or with the œsophagoscope, invented in 1880 by Sir Morell Mackenzie.

There is no difficulty in recognizing a stricture of the gullet by the passage of bougies and by auscultating the œsophageal region by the side of the spine during deglutition. Neither is there difficulty in pronouncing the stricture to be of a malignant nature, when there are present hemorrhagic expectoration, with muco-purulent discharge (assisted by microscopic evidence), progressive emaciation, pain during deglutition, and dysphagia. But these phenomena, or the more important of them, are absent during the earlier stages of the disease. Even when the neoplasm is situated above the level of the clavicles, it cannot usually be recognized by examination of the neck. Loss of appetite, contraction of the stomach, retching and vomiting upon deglutition, are general symptoms of œsophageal stricture, and do not point specially to its malignant origin. Paralysis of the crico-arytenoidei postici muscles (especially the left one) from pressure upon the recurrent laryngeal nerves, of which the left passes round the arch of the aorta and is the more exposed to pressure, may clearly be due to causes other than cancer of the gullet; but œsophageal cancer is more frequently met with in males between the ages of thirty and sixty than at other periods of life.

As to treatment, the question of extirpation of the disease can only be entertained where it is very localized and situated in the upper portion of the œsophagus. In such cases the expedience of excising the strictured portion and establishing a fistula into the œsophagus may be considered; but the heavy mortality which has been consequent upon this operation does not lend support to its performance. So far as the immediate results of the operation were concerned, Czerny performed it successfully upon a woman, who survived a year before recurrence of the disease took place.

Œsophagostomy as a palliative procedure cannot be advised, on account of the proximity of the fistula to the diseased portion and its situation in the neck, together with the dangerous nature of the operation. The objection to treating cases of œsophageal cancer by the passage of feeding-tubes is that they must naturally irritate the growth in their passage and accelerate the disease.

As soon as a diagnosis of cancer of the gullet has been es-

tablished, gastrostomy is the operation which ought to be performed. The abdominal cavity should usually be opened by an incision two inches or two and a half inches in length, practised in the angular space between the left lobe of the liver and the left costal margin. The stomach will probably be contracted, but it is quite unnecessary to attempt to distend it, as recommended by some, by inflation through an œsophageal tube. By passing two fingers into the peritoneal cavity upward, beneath the liver, the operator can reach the stomach with ease, and draw down a portion of its anterior wall through the abdominal wound. In stitching the viscus to the margins of the abdominal incision, two carbolized silk sutures should be first passed through the upper angle of the incision and through the substance of the wall of the stomach, by which means the peritoneal surfaces of the stomach and abdominal wall will be brought into contact. The process must be repeated in respect to the lower angle of the wound, and afterward three or four sutures passed on either side to adapt each edge of the wound with the stomach. The operation is to be completed by placing some iodized lint, smeared with oil or vaseline, over the wound and peritoneal surface of the stomach exposed in the gap. Three or four days later, after the general peritoneal cavity has become excluded by peritoneal exudation and adhesion, the stomach must be opened by a small incision, through which a full-sized india-rubber catheter can be passed, and nutriment introduced. The object of the operation is to prolong life by affording rest to the cancerous portion of the gullet, and to prevent the patient dying of slow starvation, which is one of the most horrible forms of death with which we are acquainted. In some cases it may be advisable to attempt extirpation of the cancerous portion of the œsophagus, as already alluded to, preferably after gastrostomy has been satisfactorily performed as a preliminary measure.

In cases of cancer of the gullet, when death does not occur from starvation, or this mode of death has been prevented by gastrostomy, the patient succumbs from perforation of the tube into the mediastinum, air-passages, aorta, pulmonary or other large vessels. When the cancerous ulceration has eroded into a large vessel dissolution occurs very rapidly by one of the pleasantest modes of death. If ulceration occurs in the

larynx or upper portion of the trachea, tracheotomy should be resorted to; or this operation may be performed in anticipation of the complication, when the anatomical position of the neoplasm renders the coincidence probable. Death by gangrene of the lungs, secondary growths, and septicæmia must always be mentioned as likely to be a natural termination of the disease.

Most of the varieties of malignant disease are met with in the larynx, but epithelioma only occurs with sufficient frequency to deserve mention. Any portion of the larynx may be attacked, but epitheliomatous growths nearly always appear upon one or other vocal cord or ventricular band. When the growth is subglottic in origin, there is greater difficulty both as to diagnosis and treatment.

In the early recognition of epithelioma of the larynx there is ordinarily much difficulty in distinguishing the disease from a benign papillomatous formation, though it can scarcely be confounded with the specific lesions of syphilis or tuberculosis.

The physical characters of the growth, with its tendency to rapid ulceration, seem to be the chief points upon which the diagnosis must be established. The removal of a portion of the growth by forceps for microscopic examination is an important help to diagnosis; but it does not seem to be generally understood that the microscope often affords merely negative evidence, and sometimes only confirms what was already obvious from a laryngoscopic examination of the neoplasm.

Small malignant growths, especially if situated posteriorly, and upon or above the level of the true vocal cords, can generally be removed from the cocainized larynx by forceps. Unfortunately, however, by these means sufficient tissue beneath the growth cannot be removed to insure non-recurrence of the malignant neoplasm. As to total extirpation of the larynx, the past results of the operation are so bad as hardly to leave any case in which it could be with propriety resorted to. Upon a different footing stands thyrotomy, to be followed by excision of the growth and surrounding soft structures of the larynx. It is now well known that the results, as shown by statistics recently adduced, exhibit this procedure also in a very unfavorable light; but the percentage death-rate consequent upon the operation itself is not very high—has been

chiefly due to sepsis, which is usually preventable—and the recurrence of the neoplasm which has usually followed thyrotomy within a few months may be attributed to an inadequate amount of laryngeal tissue around the neoplasms having been removed with them, or to the operation not having been resorted to sufficiently early.

The treatment of cancer of the larynx for most cases, therefore, appears to be either thyrotomy (with or without preliminary tracheotomy) and excision of the cancerous neoplasm with its surrounding tissues, or the palliative operation of tracheotomy, which merely prolongs life by preventing death from asphyxia, but exercises no curative influence upon the malignancy of the laryngeal disease.

Cancer of the lung is exceedingly rare as a primary, but very common as a secondary affection. The disease imitates the primary or parent growth, and accordingly all varieties of cancer may be met with in the lung, but cancer of the lung appears most commonly from extension from the breast. The lung will be suspected by the antecedent history of the case. There may or may not be marked physical signs of consolidation, and symptoms, such as cough, dyspnœa, and hemorrhage. There is no surgical treatment of cancer when occurring in the lung, or in the heart, where it occasionally appears as a secondary manifestation, not infrequently pigmented.

CHAPTER XIV.

CANCER OF THE STOMACH, INTESTINES, AND OTHER ABDOMINAL ORGANS.

CANCEROUS disease is more common in the stomach than in any other part of the alimentary tube, save the tongue and lips. The most usual varieties of malignant disease are scirrhus, encephaloid, and colloid, of which the scirrhus is the most common and is usually situated at the pyloric end of the stomach. Sometimes a malignant tumor may arise at the cardiac orifice, or near the lesser curvature or even the fundus, but such cases even taken together would only constitute a small proportion of all cases of gastric cancer.

SCIRRHUS OF THE PYLORUS.

This is the commonest form of gastric cancer. Far more common in males than in females, it usually occurs in persons aged between thirty and sixty. It exhibits no marked selection in favor of either the rich or the poor, though the larger number of cases are found among the latter and more numerous class of the community. The disease is also said to be somewhat more common among publicans and topers than among others. The frequency of cancer in the pylorus as compared with other regions of the alimentary canal is in favor of the local origin of the disease, the pylorus being a site particularly susceptible to injury from the passage of hard or indigestible masses of food; and in this connection it may be noted how old cicatrices in the mucous membrane are found post-mortem in the pyloric region, and the proclivity of cancer to develop *de novo* from scar-tissue is dealt with in other chapters.

The diagnosis of cancer of the stomach is often by no means easy. I have known the gastric crises of locomotor ataxy mistaken for symptoms of pyloric cancer by a surgeon who

ought to have known better, and the patient hastened out of the world by the ill-judged performance of gastro-enterostomy, although upon opening the abdominal cavity no tumor was detected in the pyloric region; and upon the post-mortem table no evidence of malignant disease or of pyloric obstruction was manifest. I have known the symptoms of gastric cancer mistaken for those of pernicious anæmia, and the patient treated by transfusion of blood, with the view of ameliorating or curing the anæmic condition. Real difficulty often lies in distinguishing a case of pyloric cancer from one of gastric catarrh, fibrous stenosis of the pylorus, or gastric ulcer.

Gastric ulcer usually occurs in people under thirty years of age, and often in domestic servants. Save those few cases of gastric ulcer where perforation of the viscus rapidly occurs, and the case terminates in dissolution in a few days, the ordinary course of gastric ulcer is very lengthy, tends toward cicatrization and recovery; the emaciation of the patient is only slight; hematemesis is sometimes profuse, and there may be melæna.

In pyloric cancer the patient is generally past thirty years of age, the vomiting is scanty, the hemorrhage is slight (unless some fair-sized vessel has been suddenly perforated), and the ejecta are tinted a coffee-ground color, sometimes containing microscopic evidence in favor of malignant disease. The emaciation of the patient is ordinarily great, and doubt may sometimes be cleared up by the detection of a nodular tumor in the pyloric region. The stomach will usually be distended when the obstruction is situated at the pyloris, contracted if the growth be located at the cardiac orifice. In the latter case vomiting ordinarily occurs during or after deglutition; in the former, toward the completion of digestion.

Of cachexia as a diagnostic sign I will say little, because the cachexia consequent upon cancer of the pylorus may be mistaken for that of other diseases simulating the one under consideration; and in the example above referred to, the cachexia of cancer of the stomach was wrongly deemed a sign of pernicious anæmia. The signs of simple fibrous stenosis of the pylorus will be merely those of obstruction.

The surgical treatment of scirrhus of the pylorus is resection of the infiltrated portion of the alimentary tube. The operation can, however, only have a very limited application.

For any case where the disease assumes any form other than precise limitation to the pyloric region, the operation would merely add to the already perilous condition of the patient. Up to 1885 Sir Spencer Wells had only twice seen cases where he thought the operation could be seriously advised:

"One patient was a captain of one of the Cunard steamers. He said he would submit to it after one more voyage to New York, but he died there; and I heard afterward that the disease was so confined to the pylorus that the operation would have been very easy. The other patient was a German tailor, who afterward died in the Cancer Hospital, when it was found that the disease of the pylorus had just begun to involve the liver. Mr. Jennings tried to prolong life by injecting milk into a vein of the arm."[21]

The only advantage to be gained by performing gastro-enterostomy in an advanced case of pyloric cancer would be a slight prolongation of life and temporary relief of obstruction, should the patient survive the effects of the operation.

Simple fibrous contraction of the pylorus is, I believe, often indistinguishable from scirrhus, except after microscopic examination. For simple stenosis, dilation of the pylorus by insertion of the operator's fingers, after a small vertical incision has been made in the anterior wall of the stomach a little to the cardiac side of the pylorus, has been shown by Loreta to be a very successful procedure. It may now be accepted as a canon in surgery that an exploratory abdominal incision is to be recommended in cases of suspected malignant disease of the stomach, where a diagnosis cannot be arrived at by other means.

Cancer of the Intestines and Rectum.

Modern pathologists seem to agree that malignant disease of the intestines and rectum almost invariably occurs as columnar epithelioma, which in a marked proportion of cases undergoes colloid degeneration. All other varieties of malignant disease primarily occurring in these regions are exceedingly rare. (I have recently seen a patient suffering from scirrhus of the rectum, under the care of Mr. Charlesworth, of Wandsworth.—C. E. J.) Stricture of some part of the intestinal tract is very much commoner in the female than in the male, but if

we exclude all cases of non-malignant stricture, cancer of the intestine is rather more common in the male than in the female. Primary malignant disease of the intestines constitutes about two per cent of all cases of cancer. The primary lesion is ordinarily solitary, and selects the sigmoid flexure in an overwhelming numerical majority. Next in order of situation come the junction of the sigmoid flexure with the rectum, the lower part of the rectum, the descending colon, hepatic flexure, splenic flexure, cæcum and ascending colon, transverse colon, and small intestine. Of stricture of the rectum, the majority of cases are of syphilitic and the minority of cancerous origin.

In the small intestine, nearly half of all the cases of stricture result from the cicatrization of ulcers, nearly half from malignant deposit—in many cases probably sequent to the cicatrization of simple ulcers—and a small number of cases arise from miscellaneous causes. About two-thirds of all cases of stricture of the large intestine are cancerous.

Save in the lower part of the rectum, the diagnosis of cancerous from other forms of intestinal stricture is usually surrounded with the greatest difficulty; but cancerous stricture generally occurs in persons about or over forty years of age, and is exceedingly rare under thirty. The symptoms are those of chronic intestinal obstruction, and the lower down the stricture may be situated, so much the later in the course of the disease will vomiting appear as a symptom. Paroxysmal attacks of pain, resulting from the difficulty of the passage of the intestinal contents through the strictured portion, rarer in the earlier and more frequent in the later stages of the disease, and which occasionally may be definitely located, is one of the chief positive diagnostic signs. The condition of the bowels is usually that of constipation, though occasionally constipation alternates with diarrhœa, and especially the passage of mucus. Rarely the general condition is one of diarrhœa.

Examination of the rectum with the fingers, hand, or by the passage of bougies or tubes, is only of service to determine the location of a stricture within a short distance of the anus.

Copious injections, accompanied by auscultation of the bowels, sometimes assists the surgeon in locating the site of a stricture; but it must not be forgotten that fluids will often permeate a strictured portion of the intestine readily enough

from below upward, though with great difficulty from above downward; a fold of mucous membrane may fall in a valve-like manner over the upper orifice of the strictured portion. In cancerous stenosis of the intestine, the neoplasm tends to spread circumferentially around the walls of the canal, and to produce a general infiltration of the affected portion of the tube. The disease probably exists for a considerable time before glandular affection and dissemination occur, but the growth is not usually of sufficient size to be detected by abdominal palpation, although pain may be occasioned by pressure over the affected spot. As the disease progresses, the fæces upon passing the strictured portion acquire a hardened, twisted, and diminished form.

The treatment of cancerous disease of the intestine will vary with the part affected. Early excision of the anus must be performed for epithelioma commencing primarily around the lower aperture of the bowel; or, if the growth be located within three inches' distance of the anus and be easily isolable, and especially if only a portion of the circumference of the rectum be affected, extirpation of the lower end of the rectum may be carried out. Some surgeons recommend a preliminary colotomy in such cases.

In all cases where difficulty of diagnosis exists, and the symptoms of obstruction appear dangerous to life or point to stricture of the intestine, abdominal exploration through an incision in the middle line, practised between the umbilicus and pubes, is the proper course of treatment. The abdomen having been opened, the operator should first examine the cæcum. Those coils of intestine, which are inflated, may be assumed to lie above, and those which are flaccid below the strictured site. The operator should therefore seek for some flaccid portion of intestine which will usually depend into the pelvis, and trace the intestine upward toward the stricture. Peritoneal adhesions between coils of intestine should be broken down; and even when a stricture is found, the surgeon should bear in mind the possible existence of another in some other portion of the intestinal tract, and take advantage of the opportunity now afforded for manual exploration. Some recommend that the intestines should be punctured, where distended, with a capillary trocar, either before or during the operation, to relieve flatus.

When the portion of cancerous intestine is detected, there are two courses open to the surgeon; one is to resect the diseased portion, the other to establish an artificial anus, and the surgeon's decision must be guided by the peculiarities of the particular case under consideration.

The methods of performing intestinal resection are exceedingly numerous, and I can only describe the plan which, after consideration of all of them, I believe to offer the greatest advantage. My plan consists in reuniting the divided extremities of the intestine, after excision of the diseased portion, by sutures, the process being facilitated by the insertion of a hollow cylinder of cocoa-butter or of gelatin, which dissolves shortly after the completion of the operation. The results of experiments which I performed at Ghent upon animals, at the suggestion of Sir Spencer Wells, have been described in the "Lancet," and the specimens are preserved in the museum of the Royal College of Surgeons of England. My cylinders are cast in eight sizes, conical at the extremities. They afford a firm basis and support for the intestine during the operation, and will not collapse (like an india-rubber bag) if accidentally wounded by the point of the needle. The cylinders slowly melt during the first few hours after these operations, thus allowing time for adhesion of the peritoneal surfaces at the line of union, but not too slowly to form an obstacle to the passage of the fæces. The gelatin have the advantage of flexibility over the cocoa-butter cylinders. So far as can be gathered from three experiments upon dogs, it appears—

1. That, whenever possible, the portion of intestine to be removed should be isolated from the general peritoneal cavity, by passing it through a small aperture in a sheet of transparent gutta-percha tissue.

2. That the section of the intestine should be slightly oblique to lessen the tension on the line of suture, and to prevent the great diminution of the calibre of the intestine at the seat of resection, which obtains when the division is transverse.

3. That a triangular portion of the mesentery should be excised, the base corresponding to the part of the intestine which is removed.

4. That after the piece of intestine has been removed, a cylinder slightly larger than the calibre of the intestine should be selected, in order to distend the portions to be united.

5. That the gap in the mesentery should be closed by a continuous suture, and that a double row of intestinal sutures (each commencing where the mesentery joins the intestine) should be employed to maintain the peritoneal surfaces between the two rows in contact. The inner row should unite the edges of the pieces of the intestine; the outer row should include only peritoneum or peritoneum and muscularis. By this means sufficient peritoneal surfaces will be maintained in contact; but if only one row of sutures be employed, the edges of the intestine will curl away from each other, internal to that single line of sutures.

6. Fewer sutures should be employed for the inner than for the outer row, and the stitches in the latter should not be more than one-tenth of an inch apart.

7. A single continuous suture (for each row) should not be used; for if it be, when the intestine contracts after the operation the ring of suture will not adapt itself to the lessened calibre of the intestine, and fæces will escape therefrom; whereas if interrupted sutures be employed, when the intestine contracts the points of suture will fall still closer together.

8. That Hagedorn's flat needles are to be preferred, since they do not lacerate the peritoneum so much as the ordinary needles.

9. That silk, rendered antiseptic, should be used for the intestinal sutures; the braided, which will not kink, being better than the ordinary twist.

Quite latterly Dr. Abbe, of New York, has introduced rings of catgut, by which the operations of intestinal resection or of intestinal anastomosis can be expedited. If it be possible the strictured portion of intestine, according to Dr. Abbe, should be excised, and the ends closed by invagination and sutures. Portions of the intestinal tubes are now to be brought in apposition side by side, and a communication established laterally between the coils. Incisions are made into the coils successively, and into each is introduced a catgut ring, secured in position by the passage of a few silk sutures attached to it, through the wall of the bowel from within outward. The apertures in the coils are then brought into contact by tying the silk points of suture. Lembert's suture is afterward applied around the anastomosis obtained, in order to facilitate peritoneal adhesion. The catgut rings become absorbed in a few days.

In the medical treatment of intestinal cancer not much can be said, since the patient will certainly die of exhaustion from obstruction, metastases, peritonitis, or perforation, if the growth cannot be extirpated, and the formation of an artificial anus merely serves to prolong life and relieve obstruction and irritation of the neoplasm. Still, of medical treatment the chief principle must never be forgotten, that in cases of intestinal stricture sedatives should be administered by the mouth and aperients by the rectum.

Cancer of the Ovaries.

Professor Leopold,[22] of Dresden, considers malignant disease of the ovary to constitute 22.4 per cent of ovarian tumors; Schroeder's statistics give 16.6 per cent. Sir Spencer Wells and Mr. Butlin, after a careful examination of the former's cases of ovarian tumors, found it quite impossible to determine the ratio of the malignant to the non-malignant neoplasms. Not merely may sarcoma and carcinoma attack the ovary, but both forms of malignant disease may coexist; and it has frequently struck me that the coexistence of carcinoma with sarcoma in various parts of the body is by no means so rare as many suppose.

One cannot fail to notice the tendency which some surgeons have, after removing tumors of considerable magnitude, to place them in their entirety in bottles upon the shelves of our museums, labelled with the initials of the patient and the date of the operation. A great deal more good would accrue to science were such tumors carefully dissected throughout, the neoplasms destroyed, but their dimensions, rough characters, and microscopical appearances throughout carefully noted and registered. With the limited knowledge we possess of ovarian cancer, whether papillomatous (epithelioma), colloid, encephaloid, or sarcomatous, we can only say that the smaller the growth, the less probability will there be of adhesions and dissemination to such an extent as to render the extirpation of the disease impracticable.

"Professor Freund,[23] in a recent lecture, related the history of a girl of eighteen years with malignant disease of both ovaries. On the operating-table the ovaries were found to be so adherent to the uterus that all of these organs had to be re-

moved together. When this had been accomplished, a carcinomatous nodule was discovered in a fold of small intestine. Preparations were made to exsect this portion of the bowel, when a more careful search revealed a large metastatic growth in the liver. All further operative interference was abandoned, and a rapidly fatal course of the disease was prognosticated. But to the surprise of all she recovered, and gained over twenty pounds in weight. From such a case as this Professor Freund argues against the constitutionality of carcinoma from its very beginning, since, had this girl been encumbered with constitutional disease, she would not have gained in health and strength and felt perfectly well for months after the operation. He declares that while carcinoma remains local, with no infection of the lymphatic or circulatory apparatus, and when not interfering with the function of any important organ, the surgeons should follow it relentlessly into almost every organ of the body."

Another case may be quoted as illustrative of the complications which the surgeon may have to encounter when operating for cancer of the ovary.

Billroth writes: "Three weeks ago I operated on a carcinoma of the ovary, which had grown through small intestine and the bladder. I cut away eight centimetres of small intestine, completed the enterorrhaphy; then I cut away the upper part of the bladder, uniting it with twenty sutures. The recovery was as free from fever as in the simplest case, and the patient was discharged cured after twenty days." [24]

It may be noted here that if resection of part of the wall of the

Bladder

is contemplated, the operation may either be performed, as above narrated by Billroth, by incision through the peritoneal surface and reunion of the edges, bringing the divided peritoneal surfaces in the bladder into apposition in order to promote rapid adhesion; or the operation may be performed after the method of Antal,[25] by which the bladder is first fully distended, and after the abdominal section has been made, the peritoneal covering of the bladder is peeled upward and backward out of the way, so that the operation is of an extra-peritoneal nature.

There has been published in the "British Medical Journal" [26] a brief account of eleven cases in which Sir Henry Thompson has removed tumors from the bladder, during the years 1885–88, after the supra-pubic method of Dr. Garson, and Petersen of Kiel.

"The chief points attended to in this operation were, to commence with a fully, yet prudently distended rectum, followed by a fair distention of the bladder; a sparing use of the knife, so that a ligature was very rarely necessary; the opening of the bladder by a small incision sufficient to admit the finger, but enabling further enlargement to be made by dilatation only, since after this the opening contracts, and stitching is not necessary, and, moreover, appears to be generally not advisable."

It is unfortunate that the notes of these important cases have not been reported *in extenso;* but from the outline of them referred to, I have constructed a table, showing at a glance the salient points of the cases, from which it appears—

1. That the youngest patient (No. 3) was aged 45 years and the oldest (No. 1) 73 years.

2. That one patient (No. 6) died within eleven days of the operation.

3. That in three cases (Nos. 4, 7, and 9) the tumors were probably completely removed, the patients are probably alive now, and it is hoped are completely relieved.

4. That in six cases (Nos. 2, 3, 6, 8, 10, and 11) the operations were incomplete—the growths having been inadequately removed.

5. That in most of the fatal cases the distressing symptoms were relieved, and life was probably prolonged in some of them by the operations.

6. That making full allowance for the difficulties which attend the extirpation of vesical tumors, the results of Sir Henry Thompson's cases cannot be considered satisfactory; and that where a growth is malignant, the portion of the bladder from which it springs had better be excised by elliptical incisions, and the edges reunited, after the manner of Billroth.

No.	Nature of Case.	Nature of Operation.	Result.
I.	Miss B., æt. 73. Vesical bleeding for a year and a half. Frequent micturition. Severe suffering.	October 17th, 1885. Vesical papilloma discovered by digital examination. Supra-pubic operation. Tumor size of orange removed.	Recovered from operation steadily. Symptoms relieved. Died nine months afterward.
II.	A. S., æt. 55. Frequent micturition. Hæmaturia. Patient very feeble.	November 16th, 1885. Bladder evidently filled by tumor. Supra-pubic operation. Quantity of growth removed, leaving a firm hard base.	Recovery at end of a month. Died during following year, of recurrence. (Round-celled sarcoma.)
III.	J. A. æt. 45. Frequent micturition. Hæmaturia.	October 8th, 1886. Attachment of growth to upper part of bladder detected by digital examination. Supra-pubic operation.	Wound healed in a month. Relief of symptoms. Growth reappeared in 1887. Similarly operated upon by Mr. Maurice.
IV.	H. T. B., æt. 54. Long-standing symptoms of vesical tumor.	December 8th, 1886. Large pedunculated papillomatous tumor wholly removed by supra-pubic operation.	Rapid recovery. In good health in November, 1887. No signs of recurrence.
V.	Capt. B., æt. 61. Papillomatous growth removed in April, 1885, by perineal opening. Recurrence.	February 26th, 1887. Supra-pubic operation. Large papilloma removed.	Symptoms relieved. Never regained strength. Died in June, 1887.
VI.	A. W. P. K. (age not stated). Hæmaturia for man years. Dysuria.	March 21st, 1887. Papilloma revealed by digital exploration. Fimbriated papilloma removed by supra-pubic operation.	Fever sequent to operation. Died April 1st.
VII.	Major B., æt. 62. Hæmaturia for eighteen months.	May 6th, 1887. Small papilloma removed by supra-pubic operation.	Recovery delayed by phosphatic deposits, which are frequently being removed by lithotrity.

No.	Nature of Case.	Nature of Operation.	Result.
VIII.	G. L., æt. 63. Symptoms of fifteen months' duration.	July 7th, 1887. Tumor detected by digital exploration. Supra-pubic operation.	Recovered, but died three months later from recurrence. (Eithelioma.)
IX.	N. I., æt. 57. Much blood lost during three months. Fragment of papilloma detected in urine.	July, 1887. Growth removed very like in form to preceding case.	Recovery retarded by phosphatic deposits. Wound eventually healed soundly. Free from symptoms in October, 1887, and in active business.
X.	Col. B., æt. 59. Hæmaturia for three years. Round-celled and spindle-celled tissue detected in urine. Examined, April, 1888, with cystoscope. Tumor seen.	May 7th, 1888. Tumor removed by supra-pubic operation.	June 28th, 1888. Growth developed in cicatrix, and ultimately in original site. Died a month or two later.
XI.	T. C., æt. 50. Hæmaturia for four years. Papilloma detected in débris by the microscope.	June 22d, 1888. Irregular tumor removed as near its base as possible.	July, 1888. Returned home; wound healed. Recurrence in cicatrix in November. Patient subsequently died.

Cancer of the Kidney.

The kidney may be attacked by either sarcoma or carcinoma, the former variety often occurring in the young as well as in the old, the latter attacking those past middle life. The number of cases operated upon are not sufficient to justify any strong assertions as to the advisability or otherwise of ever performing this operation; and the results naturally vary, not merely with the character of the disease, but with the skill of the operator.

Extirpation of a kidney can, of course, only be recommended where the remaining kidney is healthy. The smaller the size of the growth, the greater will be the probability of success. The advantages claimed for the lumbar operation are the better opportunities for drainage and an extraperitoneal operation. By the abdominal incision a larger tumor

may be removed, and a manual exploration of the interior of the abdominal cavity effected.

Sir Spencer Wells points out that after excision of the kidney by the abdominal method, the posterior layer of the peritoneum, which was divided to reach the organ, should be reunited, and the smooth peritoneal surfaces brought into apposition.

Cancer of the Peritoneum [27]

may lead to abdominal tumors of very different size and description, and is generally accompanied by more or less fluid in the cavity; or, as in a case mentioned by Ballard, by an effusion of gelatinous matter with great elevation of the diaphragm as in ascites, dulness on percussion everywhere but at the epigastrium and along the margin of the ribs on the right, and fluctuation in every part. The symptoms produced by this condition of the peritoneum have been sometimes so closely like those of ovarian cysts as to deceive men of very great experience. Among Sir Spencer Wells' cases, the coexistence of cancer has been sometimes so masked by the symptoms of ovarian disease that he has been led on by the hope of giving relief.

In all such cases suspicion of their real nature should be aroused if a patient has either a very thin and tense or an œdematous abdominal wall, anasarca of the lower limbs, general emaciation, a cachectic aspect, free fluid in the peritoneal cavity, and especially so if the loss of flesh and amount of pain are more rapid and severe than an ovarian or other innocent tumor would account for.

Cancer of the Liver, Spleen, and Pancreas

are, from a surgical point of view, at present of little interest. The liver and spleen are most frequently affected with secondary growths, but even when cancer arises primarily in these organs, it is usually beyond the limits of surgical interference.

Sir Spencer Wells has, however, removed many pounds' weight of hepatic tissue in one case, the patient recovering; and a good recovery followed the removal of a hydatid tumor with a considerable portion of hepatic tissue by myself in another.

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THE

TREATMENT OF EPILEPSY

BY

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CHAPTER I.

TREATMENT OF THE ATTACKS.

THE first objective point of therapeutics is the morbid manifestation, the epileptic fit, when it constitutes a danger *per se*. But we should attempt, in the main, to remove the exciting causes and to counteract the morbid irritability, both by invigorating the constitution by proper hygiene, as well as by acting directly on the nervous system by means of drugs adapted to modify its reflex action. As regards the phenomena of exhaustion and mental impairment, they are hardly amenable to other than hygienic measures which are often impotent.

Can we prevent the attacks of epilepsy? Certain patients always have their attacks under the influence of the same causes. A goodly number are only attacked after alcoholic excesses, others after mental excitement, others under the influence of peripheral irritations (lights or sounds), etc. If we can suppress these causes, the attacks may be, if not suppressed, at least considerably delayed. As regards the use of alcoholic drinks, the effect of abstinence is most evident in some patients who never have attacks except when they have been permitted to leave the asylum.

Attacks which are preceded by an aura may sometimes be prevented by suitable stimuli. Thus, a considerable number of patients suffering from partial epilepsy and who complain of distressing sensations or cramps in the limbs which always precede an attack, can arrest the paroxysm by constricting the limb at the point which is the seat of the abnormal sensation. Odier in particular has extolled the ligature

of the limbs above the aura. Excessive flexion or forced extension, twisting of one finger of the hand (Bravais) may sometimes produce the same result. Hughlings Jackson recommends violent traction of the parts which are the site of the aura. Brown-Séquard has shown that partial epilepsy, the tremor of the lower limb produced by extension of the tip of the foot, may be arrested by forced flexion. Sometimes the arrest is not produced except by a very firm ligature of the limb; sometimes a simple constriction with the hand suffices to check the beginning attack. Some patients constantly wear a sort of band which enables them at once to exercise vigorous constriction and thus to avoid the attacks in public places. As is true of certain neuralgias, there are sometimes, in epilepsy, true points of arrest whose compression produces the suspension of the convulsive phenomena. Very often these points are discovered only by accident. I have seen a patient in whom compression of the supraorbital and infraorbital nerves, at their points of emergence, abolished the attack, to whatever stage it may have advanced. In a certain number of cases the attack may be arrested during the aura by various peripheral stimuli, flagellation, beating, cold applications. One of Nothnagel's patients and another of Schultz's checked their attacks by the ingestion of table salt at the onset of the aura. The ingestion of a cold liquid or merely of a piece of bread sometimes succeeds in suspending an attack, even if it does not begin with a gastric aura. One of the patients in my service has his attack arrested if, during the malaise which precedes the paroxysm, he is struck violently in the interscapular region. Another patient does not fall if, during the period of premonitory suffocation, he hears himself called by name. A large number of cases might be mentioned in which arrest or suspension is produced by apparently insignificant circumstances.

But so far as I can judge, these different modes of arrest generally possess only a delaying action. They act almost like compression of the ovary in hysteria; the discharge is rarely prevented, it is merely delayed. Nevertheless, in Lysom's case, circular compression of the limb in which the aura was located finally produced recovery.

Compression of the carotids during the aura (Prichard) which had long been employed by Parry in the treatment of

eclampsia, has also been vaunted as a preventive measure, which acts upon the cerebral circulation. One of the best cases for illustrating the effect of compression of the carotids is that of Alexander. A patient whose painful seizures, situated in the right superior maxillary region and attended with distortion of the mouth and eyes, were produced by the slightest touch on the upper lip of the same side, found that the attacks were suspended as soon as pressure was made on the carotid of the same side, and during the maintenance of this compression the most vigorous irritation of the lip remained ineffective. As a general thing it is rare that the methods to which we have referred will suffice to arrest the attack after it has begun.

Compression by Guido Borelli's and Polizetti's method, which consists in applying the thumb and index finger of the left hand on the temporal regions, the arch formed by these fingers embracing the forehead, and placing the thumb of the right hand in the space situated below the tubercle of the occipital bone, appears to have succeeded only in the hands of these writers. The latter manipulation pretends to modify especially the circulation in the medulla oblongata.

Applications of ice to the spinal column have also been advised, chiefly in order to avoid the return of the attacks in the status epilepticus. Applications of ice to the head may also be tried. François-Franck and Pitres have found that refrigeration of the motor zone may arrest an attack of epilepsy in a dog.

Similar applications to the præcordial region have been recommended in cases of cardiac aura (Charcot). As regards the success claimed by Fleury for the douche in abortive treatment of the attack, this can only be accidental, since the measure cannot be used unless we have time to remove the threatened patient to the hydrotherapeutic ward.

On several occasions on which I was present during an aura, I have arrested the attack by a painful manipulation which was not conditioned by a local premonitory sensation; for example, by violent torsion of a limb or by very vigorous compression of the lobe of the ear. As I had no reason to suspect simulation in these cases, I have asked myself whether pain, which is accompanied by a true nervous discharge, followed like every motor discharge by a certain degree of ex-

haustion, does not constitute a sort of supplementary artificial paroxysm. The cases in which attacks of migraine, asthma or neuralgia replace the ordinary paroxysm appear to me to favor this interpretation.

Having observed, by the aid of Block's sphygmometer, that there is often a considerable increase of arterial tension before the convulsive or other seizures, which diminishes immediately after the discharge, I have asked myself whether an artificial lowering of the tension might not modify the course of the phenomena. In a patient who suffers from series of attacks at very regular intervals, I have succeeded in modifying the tension by the application of Junod's boot. This patient, who had had several series of attacks, had a tension exceeding 1,100 gms. As the attacks had the effect of decreasing the tension, I could assume that he was on the brink of a fresh attack; the application of the cups brought the tension down to 700 gms.; it rose to 900 gms. after the boot had been removed for twenty minutes; the attacks were suspended for twelve hours, then they occurred every two hours. On the following day I obtained a similar delay by the same plan. Since then, I have secured analogous results in several other patients. But Junod's boot cannot be used very easily and presents several inconveniences, so that I have tried to utilize simpler means for lowering the pressure. Ligature of the lower limbs near the trunk, proposed by Brown-Séquard under other circumstances, has been useful. But I have resorted chiefly to mustard baths and packs, which have often arrested an attack at the aura, or a series of convulsions, a trembling or a cephalalgia. These moderators of arterial tension have seemed to me to act with special effect upon attacks of maniacal excitement in epileptics, attacks which are accompanied by an increase of arterial tension. Several patients are so strongly convinced of the usefulness of this measure that they ask for its application when they feel the approach of an attack.

Ether, chloroform, nitrite of amyl, bromide of ethyl, etc., have also been employed in inhalations in order to suspend attacks of epilepsy. As their absorption requires considerable time, this mode of interference cannot rouse any great expectations. It must also be remembered that ether (Moreau of Tours), like chloroform, may provoke an attack. Never-

theless, ether seems to cause arrest of the attacks in certain special cases.

CASE I.—Epilepsy, dyspnœal sensations during the aura, possibility of arrest by inhalations of ether.

D., æt. 32 years; his father, a drunkard, died eight months before his birth; his mother had several attacks of melancholia. His father made two attempts at suicide. Of D.'s five brothers and sisters, only one suffered from mental disturbance. D. was the youngest child, the sick sister was the next youngest.

D. had convulsions, wet the bed at a late period, did not walk until nearly four years old; has always been subject to nightmare, and was very irascible. He served as a soldier and had no notable ailment until the age of twenty-five years, when he married. A few weeks later he had an epileptic attack. There are no well-marked signs of degeneracy. Exaggerated reflexes on the left side with a tendency to epileptoid tremor on this side; lowering and reduplication of the gluteal fold on same side. No sign of manifest paralysis; dynamometric pressure of the right hand 65, of the left hand 60. In some attacks the tonic contractions have predominated on the left side, but this fact is not constant.

The attacks are announced by a feeling of suffocation, by a sensation of want of air; the chest feels as if it were enormously dilated and nothing more could enter. The sensation of suffocation sometimes lasts fifteen or twenty minutes before the attack. If he can obtain an inhalation of ether during this time, the attack is prevented.

An injection of morphine during the aura has prevented or at least delayed the seizure. Wallender claims similar success with apomorphine.

After the convulsions have begun there is nothing, except in rare cases, which can arrest them. Under some circumstances, however, immobilization produces effects which are worthy of note.

In one patient who has partial attacks, often localized strictly in the right arm, which is affected with incomplete paralysis, it is possible, by a vigorous effort, to overcome the movements. But soon we find the hand and arm of the opposite side agi-

tated by spasms, and convulsive movements are produced identical with spontaneous convulsions, and sometimes following the ordinary course—*i.e.*, involving at once the head and lower limb. This fact, interesting from several points of view, may be compared with some others of a different nature.

It is well known that during the first months of life infants hardly perform any other but symmetrical movements, and this fact is utilized in the diagnosis of paralyses and articular affections at this age. This symmetry of movements is not confined exclusively to childhood. It is found in a large number of hysterical patients who manifest it even in the most specialized voluntary acts, particularly when the eyes do not exercise their control. When, in cases of this kind, the transfer of voluntary movements is provoked by applying the æsthesiogenic object on the stronger and more sensitive side, the first phenomenon produced is an increase of motor power together with an increase of sensibility and a diminution of the period of reaction, resulting from the greater flow of blood into the limb which is the site of excitation. This functional exaggeration is followed by a weakening which coincides with what is called the dynamogeny of the opposite side. In the transfer of writing, the excitant being applied to the right hand, the first phenomenon consists of a sort of hypertrophy of writing due to exaggeration of the movements; then comes the impossibility to write; then, finally, the left hand, after some hesitation, becomes capable of tracing characters and often produces mirror writing. The phenomena of transfer of writing consists, then, of an increase in the energy of the adapted movements, followed by an impotence; the left hand enters into action consecutively to this impotence of the right hand.

Hysterical individuals do not possess a special physiology, and this phenomenon is not found exclusively in them. A considerable number of hemiplegics with cerebral lesions, when directed to make a movement with the paralyzed hand, perform it with the other hand, and if told to write they often trace the characters in mirror writing with the left hand.

This tendency of the left hand to supplement the right when the latter is powerless, and which depends on the physiological symmetry of the movements, is present to a greater or less extent in normal individuals. The brother of one of

my patients at the Bicêtre presents nothing abnormal beyond the following peculiarity: the majority of the movements of the upper limbs are performed symmetrically when much attention is not paid to them; in the majority of customary movements, the limb which acts involuntarily makes movements which are less extensive and are delayed in a measure. If he is asked to write, it is found that the left hand does not remain motionless; at first the phalanx of the thumb is animated by slight movements, then the index finger takes part. These movements are not proportionate in extent to those which are being performed in the right hand. But if, after having placed a pencil in the individual's left hand, he is directed to continue writing with the right hand, which is kept as immovable as possible by holding it with our both hands, it will be seen that the left hand, although volition is turned in another direction, traces characters which are directed toward the left and among which we may recognize several letters in mirror writing. This experiment repeated upon absolutely normal individuals gives corresponding results. When the writing is performed with the right hand, no movement is performed by the left hand appreciable either to him who writes or to other observers. But if another's hand opposes the movement of the right hand, the individual experimented upon soon feels the movements in his left hand and others may detect them.

These different examples indicate that when there is an obstacle to a unilateral movement, the nervous influx has a great tendency to take the symmetrical path on the opposite side. This tendency is so much more marked, the greater the habit of symmetrical movements which the individual possesses. It should therefore be found at its maximum in young children, and at the end of a little while the path which is most often followed becomes the most easy to follow—*i.e.*, it becomes the habitual path.

These facts prove that arrest of the movement does not arrest the nervous discharge, which forces a path for itself. Hence there is reason to believe that violent attempts at restraint during an attack of epilepsy may be capable of favoring the production of visceral accidents and perhaps arrest or rupture of the heart.

In reality the measures to be adopted against an attack

of epilepsy are chiefly those which are intended to prevent wounds and suffocation.

When we are warned of the seizure by the pallor of the patient, we should protect him as far as possible against the shock, place him in a horizontal position on his back, with the head turned slightly backward, and hold him in such a manner that the violent movements will not produce contusions. It has been advised that a resisting, non-fragile body, such as a piece of soft wood, be placed between the jaws in order to prevent biting of the tongue. But this precaution is generally ineffective; the convulsive movements of the jaws usually appear at the onset and before we have time to interfere. The clothing should be loosened, especially around the neck. The windows should be opened in order to supplement the difficulty of respiration by the pure air.

When the patients have frequent attacks and are precipitated violently and suddenly on the head, it is well to make them wear a suitable head-dress, forming a cushion which guards them from the shock.

Certain special precautions should be taken at night. A considerable number of epileptics die of suffocation during nocturnal attacks, either from strangulation by their clothing, from turning the face into the pillow, or from rolling themselves up in the bed coverings. The English government publishes yearly reports of the insane asylums, from which we can note the relatively large number of deaths due to nocturnal attacks of epilepsy. These accidents have diminished in proportion as the night watch has been better organized, but we still find in these reports that some deaths in epileptics during attacks at night occur at the hours when the change in nurses takes place. This proves the necessity of constant surveillance of epileptics during the night.

We may prevent the danger of falls during nocturnal attacks by placing the patients in very low beds or in beds provided with side guards. If the guards are wadded, they are very efficient against traumatism, but form an obstruction to surveillance and increase the danger of suffocation.

An attempt has been made to prevent the danger of suffocation by giving to epileptics pillows made of sea-weed or hair, which are more permeable to air and less compressible than feather pillows. This precaution is insufficient and nothing can replace thorough watching.

Death from suffocation may also occur in another way during stertor: the paralysis of the muscles of the tongue, permitting the sinking of this organ toward the pharynx in dorsal decubitus, adds a mechanical difficulty to respiration. This can be relieved by inclining the head to the side, the tongue then drops out by its own weight, and the suffocation diminishes at once. If these simple means are unsuccessful, we must resort to artificial respiration which may furnish time for the re-establishment of the normal functions.

The post-paroxysmal sleep should be respected. The attack produces a general exhaustion which necessitates as rapid a restoration as possible. The sleep is the spontaneous process of such restoration, since it diminishes, for a time, the organic changes in the body; its suppression is often followed immediately by very persistent and distressing headache. Holland observed a long time ago that the premature exercise of the intelligence, and especially of the memory, after an attack, delays the return of these functions.

After an attack epileptics should receive very substantial nourishment, in the smallest compass possible. The catarrhal condition manifested under such circumstances is connected with the general exhaustion, which is shown by a suspension of the secretions as well as by temporary diminution of the muscular power.

In the status epilepticus, or series of paroxysms, the patient must be kept free from all irritation, the light moderated, sounds abolished, and when consciousness is returning he must be prevented, as far as possible, from making voluntary movements or speaking. In a series of attacks of partial epilepsy, for example, we will often find that the patient, without inconvenience, can move the limbs which are not affected by the spasms, while the slightest effort on the part of the affected muscles produces an attack. During the paroxysmal period of a patient suffering from epilepsy which was limited to the right inferior facial branches, the motor branch of the trigeminus and the hypoglossal, all the movements of articulation and mastication produced the spasm, although the individual could turn his head, write, and walk without inconvenience.

Various medicinal agents have been tried against the status epilepticus. Crichton Browne published four cases of recovery from the use of nitrite of amyl, but this success has

not been repeated. In fact, the efficacy of no sort of treatment has been demonstrated. One of my patients recovered under large doses of bromides (3 iv.–3 vi. daily), but three others succumbed under the same treatment. Wildermuth has recommended amyl hydrate in doses of 3 i.–ij. daily. In one case, in which the fits followed one another without intermission, he employed it in subcutaneous injections (gr. xl. in three injections).

In one case of status epilepticus which had resisted large doses of bromides., I asked Dr. Reclus to perform trephining; the fits ceased but the temperature did not fall, and the patient died without coming out of the stupor; the autopsy showed a diffuse sclerosis.

Status epilepticus appears to cause death by nervous exhaustion and by the profound disturbances of the respiratory functions. Not alone are the mechanical phenomena of respiration interfered with considerably, but the vaso-motor paralyses entail an intense congestion of the lungs which is found almost constantly at the autopsy of individuals who have died in this condition. Artificial respiration, faradization of the thoracic muscles may prove very useful.

The excessive combustions of the status epilepticus produce considerable depression and a rapid emaciation, which continue even after the convulsions have ceased. Relief must be secured at once by artificial alimentation.

When the patients have escaped death from the continued elevation of temperature, they have been nourished with the aid of the sound even during the continuance of the status epilepticus. It is a notable fact that despite the convulsions vomiting is not produced, although a pint of milk has been injected at once, with five or six or even ten eggs a day. After consciousness returns, the alimentation should be excessive in order to repair the losses. The following observation, in which the normal weight had been taken shortly before the seizure, shows that despite feeding that may be called excessive the loss of weight continued to increase for several days after the cessation of convulsions; the restoration was very rapid.

CASE II.—Status epilepticus, post-paroxysmal emaciation, restoration.

M., æt. 18 years, entered November 13th, 1889. No nervous

antecedents. Patient had violent convulsions at age of one year; nothing of moment during childhood. At age of twelve years began to have "absences," then convulsions, at first every month, later almost daily. Two years ago had status epilepticus lasting one day. Weight 146 lbs.

During the night of November 20th had four successive attacks without resuming consciousness. From 11 A.M. to 6 P.M. he had twenty-six attacks in several series. After the fourth fit temperature rose to 100½° F., after the last one to 104.5°. The cessation of the attack seems to have resulted from application of mustard pack. In the afternoon and evening he had taken ʒ iij. of potassium bromide.

Nov. 21st. Morning, T. 101.8°; gr. 75 of bromides; alimentation with sound, 3 quarts milk and 12 eggs during the day. Nov. 22d. Evening, T. 101°. Nov. 23d. Morning, T. 103.4°, weight 137 lbs.; same alimentation. Nov. 24th. Morning, T. 101.3°, weight 132 lbs.; evening, T. 101°; same alimentation. Nov. 25th. Morning, T. 103.5°, weight 132 lbs.; evening, T. 102°; patient is still sluggish, but answers correctly and eats a little in addition to the forced feeding. Nov. 26th. Morning, T. 100.4°, weight 138 lbs.; evening, T. 102°; same alimentation. Nov. 27th. Morning, T. 99.8°, weight 139¾ lbs.; alimentation, 3 qts. milk, 9 eggs, a little meat. Nov. 28th. Morning, weight 141 lbs.; alimentation, 8 eggs, 3 qts. milk, 16 ounces bread, 3 ounces meat, 10 ounces vegetables, 14 ounces soup. Nov. 29th. Weight 141½ lbs.; alimentation, 3 qts. milk, beef, the rest of diet as before. Nov. 30th. Weight 141¾ lbs.; same diet.

Dec. 1st. Weight 143 lbs.; same diet; has been up five to six hours during the day. Dec. 2d. Weight 142¾ lbs.; same diet; has been up the greater part of the day.

Numerous measures have been proposed to check the repeated attacks of acute symptomatic epilepsy. In puerperal eclampsia, which resembles the ordinary status epilepticus in the frequent elevation of temperature, resort has been had chiefly to venesection, either moderate or copious, to venesection combined with evacuants, to anæsthetics and antispasmodics. The greatest mortality occurs in cases treated by venesection. The most favorable results have been obtained by anæsthetics, which have arrested the convulsions in a certain number of cases. Chloral in particular has been

employed with success, but the greatest uncertainty prevails with regard to the indications for these different modes of treatment. The anæsthetics chloroform and ether by inhalation succeed particularly in eclamptics with hysterical antecedents; in fact, hysterical seizures are more amenable to these agents than epileptic paroxysms. The usefulness of revulsives, baths, diaphoretics, purgatives, emetics, diuretics, etc., has not been well established. When albuminuria is present, a milk diet constitutes a good preventive measure against eclampsia. If eclampsia manifests itself at full term, the induction of labor may check the seizures. In a certain number of cases, however, they persist, the source of irritation not being suppressed entirely by the expulsion of the fœtus.

Among the accidents of eclamptic paroxysms, we must mention syncope. It furnishes the indication for a special interference, viz., artificial respiration, which may permit recovery or, at least, may enable us to gain sufficient time to terminate delivery.

In view of the probability that a prominent part is played by individual morbid hyperexcitability in the development of eclampsia, it is in place to administer bromides during the pregnancy of women who have already had epileptic or maniacal seizures, or who present the evident signs of a nervous temperament.

In the other forms of eclampsia, the treatment should be directed against the etiological conditions, such as uræmic poisoning, peripheral or visceral irritation, etc.

CHAPTER II.

TREATMENT OF THE EXCITING CAUSES.—TRAUMATIC EPILEPSY, CEREBRAL LOCALIZATION, AND TREPHINING.

EPILEPSY has always been regarded as very rebellious to treatment. The ancients called it the opprobrium of the art, and Delasiauve, who has furnished the most complete study of the treatment of epilepsy, formulates his opinion as follows: "Epilepsy almost always resists the efforts of nature or art; and when it improves or recovers, it is often difficult to determine the true cause of this fortunate change." Since then this question has undergone important changes, due on the one hand to empiricism, on the other hand to scientific experimentation.

We will study the different therapeutic measures employed in the disease by grouping them according to the indications furnished by the study of the causes.

All epilepsies are symptomatic of a lesion or dynamic disorder affecting the nervous system either directly or indirectly. These lesions and the causes of these dynamic disorders may be ascertained in a certain number of cases; in the others they remain inaccessible to our present means of investigation. To the epilepsies whose causes are known we may apply the methods of rational therapeutics; the other scan be combated only by empirical remedies, among which the most useful are intended to relieve the morbid hyperexcitability. Nevertheless, the results are not always such as we might expect from treatment which directly attacks the cause. This is owing to the fact that the same cause does not always produce the same effects upon individuals with different predispositions. On the other hand, accidental symptomatic epilepsy which has lasted a long time is not necessarily modified even by the best possible treatment. When the nervous system has assumed a morbid habit, this is not necessarily lost on account

of the disappearance of the cause which gave rise to it. The convulsive habit, epilepsy, may survive the irritation which has given rise to it. Yet despite these reasons which inspire reserve, the chief indication of treatment should be directed against the visible cause.

The cases in which the indication is most precise are those in which the epilepsy is due to an injury which may affect either the central or peripheral system.

Surgical interference sometimes gives excellent results in cases due to lesions of the peripheral nerves, whether the lesions are situated in the nerve trunks or in the tissues which receive their ramifications.

Lowe, Mackenzie, Fincke, Hack, etc., have observed epileptiform attacks in connection with the presence of polypi in the nasal fossæ, and have cured them by extirpation.

Numerous cases have been cured by the removal of foreign bodies. Several recoveries have followed the extraction of foreign bodies from the natural cavities, the ear, nasal fossæ, or from the tissues themselves. The result may be equally satisfactory whether the epilepsy is psychical or convulsive. One of the most interesting cases is reported by Hufeland. A boy of thirteen or fourteen years would begin suddenly to speak in a violent and incoherent manner and finally would become ungovernable. This condition was calmed by soporifics, but the paroxysm returned whenever the boy walked about. A red spot was discovered on one foot, and whenever this was pressed a fresh attack was produced. An incision was then made and a small glass splinter removed. During the operation the patient was furious, but calmed completely soon afterward.

The removal of painful cicatrices or the section or stretching of the nerves which supply them has often relieved or cured epilepsy. Whenever the epilepsy has developed after a peripheral lesion or an irritation which may be removed or modified, the rule is to interfere. In Billroth's case in which the epilepsy developed after a fall on the sciatic, the patient recovered after simple denudation, no lesion having been discovered. Hadden reports a case of epilepsy which developed after an injury to the calf and was cured by stretching of the sciatic.

One of the patients in my wards, whose attacks seem to have

developed, or at least, if the data are regarded as doubtful on this point, to have increased in number after the appearance of corns upon the soles of his feet, had a very marked diminution of the attacks after he wore shoes with a hole in the soles that enabled him to avoid friction of the epidermic excrescences.

In a patient under Anglada's observation, gentle percussion of a carious tooth provoked an attack, and its extraction was followed by recovery.

Of late years surgeons have removed the ovaries, even when healthy, for the treatment of hystero-epilepsy. The operations which have been followed by apparent temporary success do not seem to me to justify this method in the absence of an evident lesion. In epilepsy it appears to me to be even less justifiable. Castration in the male as well as in the female does not appear to be rational unless there are organic lesions which in themselves justify the operation. Nevertheless, it has often been recommended (Chapman, Rooker, Mackenzie-Bacon). Hinsdale has published three cases of recovery after removal of the injured or diseased testicle. But in epilepsy, as in hysteria, the permanent painful phenomena are only the local manifestations of a general condition; and interference directed against these local phenomena is contrary to theoretical data and is not sufficiently grounded on experience to warrant us in recommending it. Despite the success which he claims to have obtained, we should not follow the practice of Baker Brown, who removed the clitoris under the pretext that the epilepsy was the result of peripheral irritation of the genital nerves. This practice, approved by Braun, of Vienna, has been rejected by Ullerspreger, and should be condemned.

In males other irritations which have their starting-point in the genito-urinary organs may furnish indications for surgical treatment. Fleury has insisted upon the value of circumcision in certain cases of epilepsy, and this has since been recognized by other authors; at all events, the circumcision often has excellent effects upon the cases of incontinence of urine. It is to be remembered that this operation has no chance of success unless it relieves an irritation. In eighteen epileptics who had undergone this operation in my wards as a hygienic measure for a simple malformation, there was no modification of the convulsive attacks.

Among the traumatic lesions of the nervous system which may give rise to epilepsy, lesions of the spinal region have rarely been mentioned. In these cases, moreover, the epileptic attacks are hardly more than a secondary phenomenon.

Traumatisms of the cranial region are much more often at fault, although all lesions of the cranium and all cephalic shocks may not be regarded as lesions of the central nervous system. In a certain number of cases in which epilepsy has developed after an injury to the head, the integument or the bones alone have been affected. The wound must, therefore, be studied with great care before deciding on surgical interference. When the cause consists of a superficial peripheral lesion, it is not necessary to undertake a serious operation at the start. There may be reason to believe that it has acted by a general concussion of the nervous system or by reflex irritation. We are then warranted in resorting to the measures to which we attribute an effect of the same character—*i.e.*, to revulsives. A simple irritant applied to the scalp may succeed in moderating the symptoms or even in causing their disappearance. The revulsive may be employed in the form of flying blisters or repeated actual cautery. These mild and only slightly painful measures may be tried even when there is reason to suspect that the irritation is situated more deeply. Indeed, I have seen successful results from the actual cautery in cases of partial epilepsy with permanent motor disturbances due to intracerebral foci. When epilepsies of traumatic origin are manifested by apparently general attacks, without any predominant localization, the revulsives may be applied at the site of the peripheral lesion. When, on the contrary, the attack is clearly localized at the beginning or predominates in one limb or one side of the face, we must apply the revulsive to that point which the doctrine of cerebral localization seems to point out. In all these cases, however, it must not be forgotten that the action of the external traumatism as a determining cause is often favored by the individual predisposition of the individual. We must not neglect to use, in addition to the external measures, the appropriate tonics and anti-spasmodics.

When the traumatism has been more violent and has given rise, in addition to the epileptic manifestations, to the phenomena of compression, there is reason to suspect compression

or extravasation at the point of application of the blow; primary trephining should then be performed.

When the traumatism is not followed immediately by convulsions and has recovered spontaneously or as the result of appropriate treatment, but spasmodic or vertiginous disorders have developed after a longer or shorter interval, the plan to be adopted is less clearly indicated. These disorders may be associated either with a depression of the skull and excessive callus, or with a meningeal neoplasm secondary to the traumatic irritation, with a hemorrhagic extravasation or inflammatory product, or with an abscess of the brain. Cases have also been observed in which cerebral shock has given rise to tumors of other kinds.

Surgical interference is indicated by the mere fact of the coincidence of epilepsy with a traumatic lesion. When there are vertiginous disturbances or spasms without fixed localization or pain, we must be guided either by the depressions in the skull or, if they are absent, by the cicatrices of the scalp and the history with regard to the region which sustained the injury.

CASE III.—Traumatic epilepsy cured by trephining. D. T., æt. 36 years, entered my epileptic wards on July 30th, 1887. No hereditary taint discovered and the patient was well until November 28th, 1870, when he received a fracture of the skull from a gunshot wound; it healed in a few weeks. Six months later had the first convulsive seizure with loss of consciousness, but none in the next eighteen months. Since then has had, at varying intervals, vertiginous and convulsive attacks, but during this time he served with the Dutch Colonial troops and in the Bulgarian war. He first entered the Bicêtre in 1883, but did not remain long; this stay in the hospital improved him only by depriving him of alcohol, which exerted a manifest influence on the return of the attacks. Apart from alcoholic excesses he has, on an average, two attacks a month; several times, after having drunk absinthe, has had five or six attacks in one day.

The patient is active and intelligent. In the median part of the frontal region is an irregular cicatrix, with ramifications in different directions, and whose general direction is obliquely from left to right and from behind forward. This cicatrix is

nearly eight centimetres long; it presents several more depressed points from which splinters of bone are exfoliated from time to time. Exploration of the cicatrix is rendered impossible by the fact that pressure upon it is always followed by an attack or at least by vertigo. Simple shaking of the hair in this region is extremely painful. The entire cicatrix is situated in front of the auriculo-bregmatic plane—*i.e.*, the vertical plane which passes through the auditory canals. It is entirely in the frontal region and hence at a great distance from the motor centres. It corresponds almost to the two middle fourths of the first frontal convolution.

As the patient states that the projectile did not penetrate, the site of the cicatrix permits us to assume that the convulsions are not due to an irritation of the motor centres, the local and direct consequence of the wound. Moreover, the manifestations in no respect resemble partial (Jacksonian) epilepsy. As a general thing the attacks are preceded for twelve, twenty-four, or even forty-eight hours by a pain in the head, confined at first to the cicatrix, then extending to the entire convexity of the skull. There is no immediate warning of the attack. The patient grows pale, falls suddenly with a loud cry, the limbs extended. Then a few clonic movements are noticed, mainly on the right side. The attack lasts about a minute and is not followed by stupor. Dynamometric examination has been made after several attacks. In the normal condition it shows 55 in the right hand, 47 in the left hand; immediately after the attack we have found a loss of 19 in the right hand, of 5 in the left hand.

The vertigo, when it develops spontaneously, consists simply of pallor. When produced by irritation of the cicatrix it is accompanied by muscular contractions.

On October 29th Dr. Reclus trephined the patient. During chloroform narcosis pressure on the epileptogenic region did not produce a spasm, and it was shaved without causing any reaction. It was then found that the region which presented the most distinct depressions was to the left of the median line; the disk of bone removed by the trephine was about one and one-half centimetres in front of the bregma, and touched on the median line; the dura mater presented no appreciable change. A week after the operation the wound had healed (November 4th), and on November 6th the patient left the bed.

On November 12th had slight "absence" which did not resemble his former vertiginous attacks. On November 14th the dressing was removed definitely, and various irritations of the skin produced no result. January 5th, 1888, he left the hospital, drank excessively, and was arrested for drunkenness, but did not suffer from an attack. This patient was presented before a medical society on February 24th, 1888; he had had no fresh attack and none could be produced by irritation of the region operated upon.

This observation shows that a wound of the head, situated outside of the so-called motor region, may give rise, like any other peripheral lesion, to the phenomena of general epilepsy. When assured that these phenomena do not present the characteristics of partial epilepsy, we may interfere without reference to the motor centres, and the surgical operation may result in recovery, either by removing the organic cause of irritation or by producing a stimulation which modifies profoundly the disordered dynamic state of the nervous system.

In the absence of any visible bony or superficial changes, fixed pain in the head is an important guide, because it very often occupies the site or at least the side of the lesion. If the spasms are clearly localized at the beginning of the attack, we will be guided by the data of the physiology of cerebral localization and cranio-cerebral topography. When, in addition to the pain situated on the side opposite to the localized spasms, a certain degree of permanent paralysis is present on the same side as the initial convulsions, there is a still greater chance that the data of cerebral physiology will furnish precise indications. Echeverria has reported that among 145 cases of traumatic epilepsy, there were 93 cases of recovery and 18 cases of improvement as the result of trephining; there were also 28 deaths. The recent progress in surgery permits us to hope for a more favorable prognosis, at least as regards the results of the operation itself.

Although the long existence of the symptoms constitutes an unfavorable condition, it is by no means a counter-indication. Larrey has reported a case of traumatic epilepsy which was cured at the end of thirty-three years by the extraction of a splinter of bone.

In the absence of an injury, the occurrence of a localized

or predominant spasm, coincident with pain on the opposite side of the head, especially if there are also permanent and gradually developing paralytic phenomena in the limb more affected by the spasm, furnishes a precise indication for the same surgical interference. Localized subjective sensations and auras also serve as valuable indications. Contemporary surgery reports several successful removals of tumors. The existence of signs of a tumor has not appeared indispensable to justify surgical interference, especially if rapid interference is demanded by the constant recurrence of convulsions. In Lépine's case, for example, trephining, which was indicated by the status epilepticus, did not disclose a gross lesion and yet was followed by apparent recovery which continued four months. In these cases the operation appears to act by modifying the intracranial pressure.

Bendanti reports that he trephined a man of thirty-seven years on account of extremely grave convulsive phenomena; in addition, there was an intercurrent hemiparesis. No neoplasm was found and the cerebral cortex was vainly incised. Nevertheless the epileptic phenomena have not reappeared. But we may await with suspicion the final outcome of this case, and also of another one reported by Lépine, in which no lesion was found. It is not rare to find that the intervals between the attacks become spontaneously longer after the status epilepticus. In Hutton and Wright's case in which no cerebral lesion was found, the attacks recurred some time after the operation; in a third case, operated upon by Lépine under the same conditions, the attacks did not cease.

In several cases in which no gross lesion was found after opening the skull, resort was had to faradic stimulation of the cortex in order to find the exact site of the cortical centre, which was shown, by the local convulsions, to be changed. The stimulation was repeated until movement was produced in the parts which were the site of the spontaneous morbid convulsion (Keen, Lloyd and Deaver, Mills). The localization having been accurately determined, the portion of the cortex involved was removed. In Keen's case the attacks increased in number for some days after the operation, and their final disappearance is not sufficiently established. In Lloyd and Deaver's case they reappeared after apparent recovery. In Mills' case recovery had lasted five months, a period too short to warrant the prediction of recovery.

Excision of the cortical centres has not yet produced a radical cure of partial epilepsy. When cortical epilepsy does not result from gross lesions, our knowledge of pathological anatomy permits us to suspect that it is associated with histological lesions, but these are more or less disseminated or diffuse. Hence the removal of one part will be ineffective. The temporary improvement may be attributed to local stimulation of the tegumentary coverings as well as of the brain, inasmuch as the improvement is found even in those cases in which the brain has not been touched. This action is not surprising, because we know that pain, like spasm, is associated with a discharge of the nervous system, so that in epileptics painful phenomena often take the place of convulsive seizures. Whether the pain is provoked or spontaneous, whether the individual is conscious or has been rendered unconscious by anæsthetics, we can understand that it may have the same effect.

One of the inconveniences of excision of the cortical centres is the persistence of more or less extensive and permanent paralysis. This does not apply to the extirpation of tumors, which is indicated whenever we can ascertain their superficial position and exact situation. Among the most remarkable results in the removal of tumors we must mention those of Bennet and Goodlee, Horsley, Weir and Seguin, Ranine, etc.

Ballet, Gélineau, and Péan have reported recently a very curious case of Jacksonian epilepsy cured by trepanation. The patient was a young man of twenty-eight years, in whom the epileptic symptoms, which date back four years, were characterized by painful spasm of the right great toe, rigidity of the corresponding lower limb, tonic followed by clonic convulsions of this limb, with extension to the arm and face on the same side. The loss of consciousness was never initial and was always incomplete. During the intervals there was a paretic condition of the right lower limb. It was supposed that this epilepsy was due to a tumor situated in or near the motor centre of the right lower limb, and trephining was performed accordingly. A fibro-lipoma was found developing at the expense of the dura mater; it was removed by enucleation and an antiseptic dressing applied. At the end of several months a relapse necessitated another operation, and it is doubtful whether this will be followed by permanent success.

May we resort to the trephine even when there is no traumatic antecedent, no sign of tumor, and no trace of localization in the convulsion? Tissot has extolled this mode of treatment, but the cases of recovery under such conditions are doubtful. Among Lucas-Championnière's thirteen operations, reported in Dumas' thesis, in four there was no result, in one the vertigo persisted, in seven the attacks remained absent until leaving the hospital, but further data are wanting. In only one case the patient was under observation for ten months, but no statement is made concerning the number of previous attacks.

The improvement is transitory and is not necessarily attributable to the operation. We know, in fact, that every violent interference, whether medical or surgical, is capable of modifying temporarily the course of epilepsy. The influence of intercurrent diseases is a striking illustration. I have seen suspension of the attacks for several months after a pneumonia; I have also reported a case in which the same result ensued, after an operation for prolapse of the rectum. Brown-Séquard mentions a case in which an erysipelas was the cause of permanent recovery. MacLaren has reported two cases of suspension of the attacks by suppuration, and one by a fracture of the humerus. Hence it is not astonishing that issues have often been employed in the treatment of epilepsy.

Association with intolerable headache, even when diffuse and not localized, may constitute an indication, especially if the attacks are frequent and grave. Trephining is so much more justified as a *dernier ressort*, particularly in cases of status epilepticus, when internal drugs and revulsives have failed, because the operation is not a serious one since the recent advances in antiseptic surgery.

In the absence of all traces of traumatism, the site of the operation cannot be determined except by the notions supplied by cranio-cerebral topography. We know that the most important motor centres are situated in the convolutions which border the fissure of Rolando. Hence we must particularly investigate the relations of this fissure (Fig. 1). In order to find this, it is sufficient to determine two planes, a horizontal one, passing through the glabella and lambda, and a vertico-transverse one, passing through the middle of the two audi-

tory canals and the bregma. The horizontal or glabello-lambdoidal plane of Hamy, which indicates by its posterior extremity the position of the external occipital fissure, passes very close, often within a few millimetres, of the superior portion of the temporal bone, whose culminating point corresponds very closely to the angle at which it is cut by the auriculo-bregmatic plane. The point of intersection of the two planes, vertical and horizontal, together with the pterion (junction of coronal and spheno-parietal sutures), give the

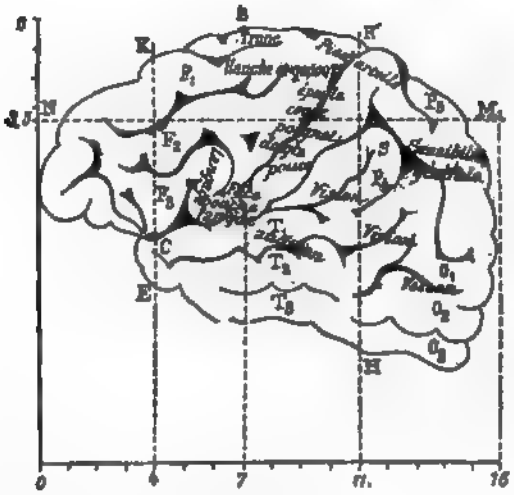


FIG. 1.—EXTERNAL SURFACE OF THE LEFT CEREBRAL HEMISPHERE. F_1, F_2, F_3, the three frontal convolutions; RR^1, fissure of Rolando; P_3, superior parietal lobules; P_4, inferior parietal lobule; O_1, O_2, O_3, occipital convolutions; T_1, T_2, T_3, temporal convolutions; CS, fissure of Sylvius; B, bregma; C, pterion; the plane MN, passing 35 mm. below the convexity of the hemisphere, gives the upper level of the central ganglia; KE corresponds to the anterior border of the corpus striatum, R^1H to the posterior border of the optic thalamus.

approximate direction of the fissure of Sylvius in its first part, the fissure being two to three millimetres from the line indicated by these two points. The horizontal plane generally is found with ease on the living subject, because the glabella is readily recognized and the lambda almost always presents an irregularity which indicates its position (Fig. 2).

The auriculo-bregmatic plane or vertico-transverse plane of Busk is especially important in determining the position of the fissure of Rolando. It enables us to determine above the postero-superior extremity of the fissure, which is situated 45

millimetres behind the bregma in the female and 47 to 48 millimetres in the male. The inferior extremity of the fissure of Rolando is 45 to 55 millimetres behind the external orbital apophysis, nearly one centimetre above the glabello-lambdoid plane, and the same distance behind the vertical or auriculo-bregmatic plane—*i.e.*, the lower extremity of Rolando's fissure

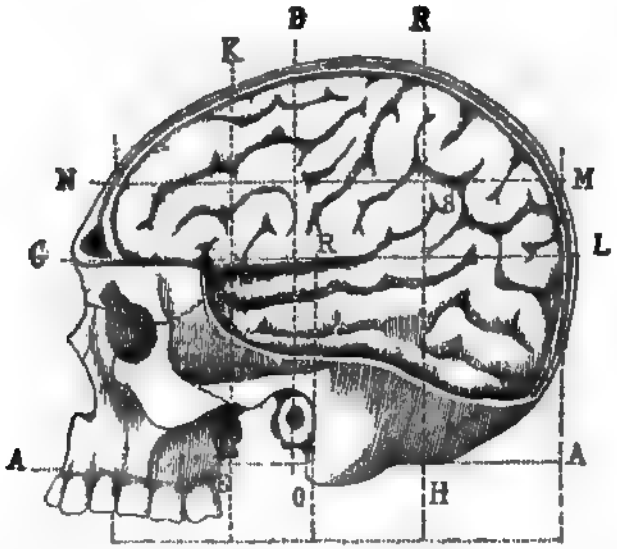


FIG. 2.—CRANIO-CEREBRAL TOPOGRAPHY.—B, bregma; C, outer extremity of coronal suture; L, lambda, S, fissure of Sylvius; RR¹, fissure of Rolando; R, its anterior tip, about 3 cm. behind the outer extremity of the coronal suture; R¹, its posterior tip, about 45 mm. behind the bregma; AA¹, alveolo-condyloid plane; OB, auriculo-bregmatic plane; GL, plane passing through the smallest transverse diameter and the lambda; KE, plane passing between the two gyri of the third frontal convolution at the point C, corresponding to outer extremity of coronal suture; R¹H, plane passing through posterior tip of Rolando's fissure and behind the optic thalamus; NM, plane passing along lower surface of corpus callosum and above the central ganglia.

is found in the postero-superior angle formed by the intersection of our two planes.

The determination upon the living of the auriculo-bregmatic plane is much more difficult than is that of the glabello-lambdoid plane, for it is exceptional to detect, in a precise manner, the point of intersection of the sutures at the level of the bregma. In order to fix this point without a special instrument, I have relied upon the fact (which is approximately correct) that when the individual is looking in a horizontal direction the bregma is in the same vertical plane with the

external auditory canal, and I have been satisfied to determine this vertical plane with the naked eye. This method was devoid of precision, especially as I did not take into account the obliquity of the osseous and membraneous auditory canal. This obliquity, according to some measurements made by Terrillon and myself, averages one millimetre. Lucas-Championnière has vainly endeavored to make this method more exact because, in the majority of cases, it will be impossible to place the patient in such a position as if he were looking horizontally. The method of determination by Broca's flexible auricular square appears to be more precise, but it is far from being perfect.

The transverso-vertical plane or auriculo-bregmatic plane of Busk may be regarded as almost exactly vertical. Camper's plane, on the other hand, which passes through the middle of the auditory canals and the nasal root, is approximately horizontal.

It is upon these facts that the construction of the auricular square is based. This instrument is made of two narrow ribbons of steel fixed at a right angle upon one another so as to form an inverted T; a small boxwood plug is fixed upon the horizontal ribbon in the direction of the posterior rim of the vertical ribbon. When the plug is placed in the left auditory canal and the anterior branch of the horizontal ribbon is brought upon the root of the nose, this blade is situated in Camper's plane. If the vertical ribbon is then bent upon the convexity of the cranium by making it pass through the point where this border cuts the median line, it should correspond to the intersection of the coronal and sagittal sutures, to the craniometric bregma, since the auriculo-bregmatic plane is perpendicular to Camper's plane. This occurs in the majority of cases, at least in adults. Broca had thought that, in the living, by placing the plug in the auditory canal, the anterior branch of the horizontal ribbon under the columna of the nose and folding the vertical blade back upon the other auditory canal, the point where the posterior border of the latter blade crosses the median line should correspond very closely to the craniometric bregma, and he applied to this point the term cephalometric bregma. But new investigations have shown that there is no perfect correspondence between these two points.

In order to find the cephalometric bregma with the aid of Broca's square, we must proceed with the greatest precaution; the plug should be pushed deep into the left ear, so that we may obliterate as much as possible the obliquity of the membranous auditory canal, and the axis of the plug may be almost in the bi-auricular axis of the cranium. In addition, the vertical blade should be placed on the right ear in such a way that its posterior border corresponds to the base of the tragus and not to its apex, in order to take into account the obliquity of the auditory canal. The anterior branch of the horizontal ribbon should be applied to the upper lip and under the columna of the nose. It is not to be forgotten that the axis of the plug is fixed upon the prolongation of the posterior border of the vertical branch of the square; it is the point where this border crosses the median line that indicates the cephalometric bregma.

We can fix the relations of this point to the skull by incising the scalp transversely and deeply upon the posterior border of the ribbon, so that the knife leaves an easily-recognized mark upon the pericranium and bone (Broca), or by pushing through the integuments an awl which penetrates the bone. After having removed the soft parts, it only remains to measure the distance which separates the transverse line or the awl from the craniometric bregma. From all these investigations it follows that, on the average, the cephalometric bregma is nine millimetres in front of the craniometric bregma; but this average does not furnish a practical starting-point, and it must not be forgotten that in the adult there may be a difference of nearly three centimetres in the positions of the cephalometric and craniometric bregma. Hence follows an important source of error in the determination of the relations of the convolutions in the living subject. These differences are due to variations in the thickness of the tegumentary coverings of the root of the nose and of the shape of the columna which makes the square incline more or less forward. In practice it is necessary to move backward for about one centimetre the bregma obtained by the flexible auricular square, and whenever we can, to obtain one fixed starting-point by searching for an osseous irregularity at the level of the bregma.

On account of the slight development of the face in chil-

dren, the craniometric bregma is carried far forward, relative to its position in the adult; it is only toward the sixth or seventh year that an equilibrium is established between the anterior and posterior parts of the cranium. The differences in the cerebro-cranial relations at different ages are also due in great part to the lack of parallelism in the development of the bones of the skull.

It is well to remember, however, that on account of the large size of the crown of the trephine, the discovery of the point sought for has not been difficult for any operator.

The method of operation which we describe is that employed by Lucas-Championnière.

The scalp should be thoroughly shaven and then washed carefully with an infusion of Panama bark (Quillaja saponaria), which removes the fat with which the head is moistened. The head is carefully washed with the phenic solution, then as an extra precaution it is made antiseptic by Laplace's solution (℞ Hydrarg. bichlorid., 1 gr.; acid tartaric, gr. v.; distilled water, 1,000 gr.), which is not transformed into albuminate of mercury on contact with the tissues. With the aid of a dermographic pencil we then map out the Rolandic line according to the method which we have indicated. A T-shaped incision is then made with the bistoury, one of the branches corresponding to the Rolandic line; the incision should involve the periosteum so that this forms a starting-point. We may also make an incision in the shape of a crescent or semicircle whose extremities terminate at a point near the ends of the traced lines. Championnière frequently employs this form of flap, particularly when he intends to open the dura mater and expose the brain; the flap offers a better protection in case of hernia of the brain through the meninges.

Forceps are applied to all bleeding vessels so that the operation is dry; this point is important, because the blood may interfere considerably. In addition, it must not be forgotten that one of the inconveniences of trephining is the often considerable loss of blood, and it is best to prevent this early.

A flat chisel is then used to remove the periosteum over the entire region which is to be trephined. When the bone is exposed, the landmark must again be noted, by pushing back the integument on the cranium and especially by examining

the mark traced on the periosteum; this point being recognized, the trephine is applied. Championnière uses one whose crown is thirty millimetres in diameter. It must be remembered, however, that in using such large-sized instruments one edge sometimes penetrates the skull before the other, and we run the risk of wounding the meninges before raising the disc of bone. There are regions in which a small crown of twenty to twenty-two millimetres is preferable.

We must proceed slowly and cautiously. From time to time the groove made by the saw must be explored and an attempt made occasionally to detach the bony disc. Certain skulls are very thick, others are extremely thin, and the individual variations are often as 1:2. After the disc is detached, possible adhesions of the internal table to the dura mater are carefully freed. These adhesions are found not alone in cases of fracture, but also in skulls which have never suffered an injury. Apart from these adhesions, the intra-cranial tension often interferes with the manipulation of the instruments.

At this stage Championnière employs a method which is peculiar to himself. Instead of applying the trephine several times and detaching the pieces of bone which separate the discs, he prefers to enlarge the edges of the opening by means of bone forceps; in this way, by insinuating one bit between the inner table and the dura mater, he removes a series of pieces of bone and gives the opening any shape and size desired. In order to do this, we must have several forceps of various sizes, and care must be taken to round off the angles which are formed. With this precaution we can avoid all projections and make the opening perfectly regular.

We do not deny that this mode of operation requires skill and experience, but, when performed by an expert hand, it is very convenient and rapid, especially when the skull has a moderate thickness.

If a rather large diploic vessel bleeds during this operation, it may be closed with wax. Horsley uses paraffin for this purpose.

After the opening has the shape and size desired, the dura must be incised. This should be done with the greatest care in order to avoid wounding the numerous vessels which pass to the surface of the brain and which may give rise to a hemorrhage that is combated with difficulty. A small nick is

made in the dura with the aid of a bistoury and the incision then enlarged with a pair of scissors. The procedure must then be adapted to the circumstances which have led to the application of the trephine.

If the case is one of idiopathic epilepsy, the brain should not be touched if healthy. In a case of cerebral tumor, the growth should be removed entire, the surrounding unchanged tissues being spared as much as possible. Splinters of bone buried in the brain as the result of trauma should be liberated and removed.

If, during these manipulations, one of the numerous vessels which run beneath the pia mater is opened, resort must be had to compression. Strange as this procedure may appear, it renders great service and is almost always successful. For very severe hemorrhages Championnière adopts the plan recommended by Lister, viz., ligature with catgut; he has obtained excellent results, even when the superior longitudinal sinus was opened. When the opening is sufficiently large we can recognize distinctly the convolutions that are exposed to view. An exact knowledge of the convolutions that appear in the operative field is of evident importance, particularly in cases of symptomatic epilepsy.

As soon as the dura mater is opened, the cerebro-spinal fluid escapes in larger or smaller quantity and mingles with the blood which remains upon the surface of the brain, and also with that which is often furnished abundantly by the soft parts. This discharge continues for the next few days, but is rarely considerable for more than forty-eight hours.

The flow of blood being checked and the operative indications for each particular case being fulfilled, how shall the operation be ended?

If there is no fear of compressing the brain or of injuring it with a suture, if there is no increased tension of the organ, we can introduce into the membrane a few sutures which will not interfere with the escape of the cerebro-spinal fluid.

Championnière usually ties very few vessels. When the forceps are removed, blood rarely flows from the larger vessels. Lavage with the strong phenic solution, which had been carefully applied to the brain and dura mater, is renewed before closing the wound, and the sublimate solution is also applied. The scalp is sutured with catgut; a drainage tube is intro-

duced to facilitate the escape of the cerebro-spinal fluid and to act as a safety-valve. The position of the tube must be carefully watched. It is very important that it should evacuate the fluids, but it must avoid touching the cerebral substance; it is sometimes necessary to remove it promptly on account of paroxysms produced by its contact with the brain.

Championnière's dressing is always the same: a thin layer of iodoform gauze, sachets of antiseptic powder (iodoform, benzoin, quinia, carbonate of magnesia), turf-mould enveloping the entire head. This envelope is very important; it protects the region, absorbs all the fluids, and its antiseptic protection is such that despite considerable impregnation with fluids, the wound remains absolutely aseptic.

CHAPTER III.

TREATMENT.

Etiological and Theoretical Indications.

The therapeutics of epilepsy has engendered much skepticism, due to circumstances connected with the spontaneous course of the disease and the peculiar sensibility of the individuals. Epilepsy undergoes spontaneous exacerbations and remissions, the cause of which it is often impossible to ascertain. At other times it is easy to recognize that it is modified by the slightest external or internal irritations. In a certain number of patients any therapeutic interference will produce, for a time, a modification in the course of the attacks, but when the patient has become accustomed to the drug the disease resumes its natural course. We must also accept with the greatest reserve the pretended cures which follow a treatment of a few weeks. This is usually a mere respite and then the disease often exhibits a compensatory relapse. A legitimate hope must be based mainly on the treatment of the causes.

It is not alone in cases due to traumatism or peripheral irritations that the study of the causation furnishes valuable indications. Whenever there are visceral disturbances we may sometimes, by relieving them, put an end to the epilepsy. It is, therefore, necessary to treat all the somatic disturbances of which we are cognizant. We must examine all the organs and attempt to re-establish the functional integrity of those that may be deranged. Constitutional diseases should not be neglected; epilepsy may be one of the manifestations of gout, diabetes, etc. In a word, it must not be forgotten that the nervous system does not functionate normally except in a normal organism. Certain organic disorders appear to be a more frequent cause.

The condition of the digestive functions should be watched

in all neuropathic individuals affected with disorders whose cause is not clearly ascertained. Although it cannot be said that gastric disorders or intestinal worms are a frequent cause of the paroxysms, it is none the less certain that, when such an etiology is recognized, therapeutics offers specially effective remedies. The expulsion of intestinal worms, ascarides, tænia, etc., has produced recovery in a number of cases, even in adults. The epilepsy of gourmands or that associated with special gastric susceptibilities may also be relieved by appropriate regimen. Delasiauve has insisted upon the influence of constipation on the repetition of the attacks and has extolled the administration of purgatives, which may even be followed by recovery in some cases.

When the appearance of the epileptic disorder is manifested in connection with suppression of the menstrual flow or of hemorrhoids, the restoration of the flux may be attended with some chance of success. Apart from the cases in which the suppression of a flux may arouse the suspicion of the congestive nature of the epileptic manifestation, there are rare cases in which the epilepsy develops in plethoric subjects, suffering constantly from cerebral fluxions, and which may be relieved, perhaps even cured by repeated venesections at regular intervals, more or less frequent and more or less abundant according to the constitution of the individual.

When the epilepsy is due to toxic influences, we must first remove the cause and place the individual under the best hygienic conditions possible. These precautions may suffice in the epilepsy of lead-poisoning, in which, according to Nivet, Tanquerel des Planches, Grisolle, etc., active medication has very little success. These measures are also often successful in alcoholic epilepsy. A large number of these patients remain free from any morbid manifestations so long as they are in an institution, but have attacks as soon as they leave or receive even small amounts of alcohol.

But if the hygienic measures, applied vigorously for a sufficient lapse of time, have not suppressed the attacks or other manifestations, we must proceed as in epilepsies of unknown cause—*i.e.*, we must resort to empirical remedies.

Certain epilepsies of toxic origin never can be modified by exclusively hygienic treatment. Such, for example, are those which are due to malarial causes. Some of these cases ap-

pear to be authentic and ceased after the use of sulphate of quinia.

The epilepsy connected with syphilis requires very vigorous specific treatment. During the secondary stage mixed treatment may rapidly arrest the attacks, but the evolution of the affection does not then present such a gravity as to endanger the patient's life. At this stage syphilis acts rather as an exciting cause of epilepsy in strongly predisposed individuals in the same way that it often gives rise to hysteria. In the tertiary stage of syphilis we must resort to treatment of the attack, according to Charcot's expression—*i.e.*, must forthwith employ mixed treatment in heroic doses in the shape of mercurial inunctions 10 to 12 gm. and potassium iodide 4 to 8 gm. daily. Care must be taken to watch the condition of the mouth and the stomatitis of alarm, as Fournier calls it. This complication as well as digestive disorders may create a serious obstacle to treatment which should be continued, so long as tolerance permits, until the cessation of the attacks, and then resumed for periods of a fortnight with intervals of rest for several months.

Of late years it has often been recommended to administer mercury hypodermically, as this usually causes no disturbance on the part of the intestines. But according to Fournier this mode of treatment has not shown any evidences of superiority in tertiary syphilis. Loewing employs a solution composed of hydrarg. bichlorid. 5, sodium chloride 1, distilled water, 100. One Pravaz syringeful contains 5 milligr. of sublimate. Martineau recommends the ammonio-mercurial peptonate in a solution containing about 1 centigr. of corrosive sublimate to a Pravaz syringeful. As much as two to two and one-half centigr. of the sublimate may be administered. Fournier has arrived at the following conclusions concerning the employment of this method:

1. Patients should be spared the inconveniences of injections as much as possible. 2. They are indicated in cases in which other methods have failed, when the attacks are frequent, when the digestive tract is intolerant and is required for the administration of other drugs, or when the skin tolerates inunctions poorly. Finally, it is also indicated in grave cases in which rapid mercurialization is demanded. Some successful cases have been reported. The method is rational in

principle, but we do not possess sufficient data to warrant a conclusion.

Mercurial injections require a certain number of precautions in order to prevent accidents. The instrument should have a gold or platinum canula and should be absolutely clean. The solution should be filtered in order to keep it clear. These precautions having been taken, the injection should be performed according to three plain rules.

1. It should be made according to the rules of the most vigorous antisepsis. The hands, instrument, and needle should be perfectly clean, the needle being passed through the flame of an alcohol-lamp. The skin at the site of injection should be washed with a phenic solution.

2. The injection should always be made deeply, under the skin, not into the skin.

3. Finally, the injection should be made in regions which are rich in cellulo-fatty tissue. Some regions are tolerant, others intolerant. Terrillon observed that when the injection was made on the inner and upper surface of the thigh, an abscess almost always followed, while an injection in the back, in the same patient, did not give rise to an abscess. There are three favorable regions, the retro-trochanteric fossa, the small of the back, and the gluteal region. The first-mentioned site is the best because it is not subjected to pressure, even during dorsal decubitus.

Caution should be exercised in injecting insoluble preparations, especially in cases which require rapid interference.

When the effects of the treatment are not felt rapidly, the prognosis becomes less favorable, but it must be insisted on so long as the patient tolerates the drugs. During the intervals potassium bromide is often very useful by acting upon the nervous erethism. At the same time we should endeavor to facilitate the elimination of mercury and potassium iodide by muscular exercise in the open air and mild purgatives. Milk, which has been recommended by Maviet, presents real advantages in this regard. When the attacks are under control, sulphur thermal waters may be recommended with advantage.

During the entire course of treatment of syphilitic epilepsy, the patient should be kept under strict hygiene. It must be remembered that a cerebral localization of syphilis is favored

by a special predisposition, by a native irritable weakness of the nervous system, and that the excessive exercise of the mental functions appears to precipitate its development. We know that, as a general thing, medical intervention acts only by suppressing the cause of irritation, but that nature alone is charged with the process of reparation. On the other hand, this process of reparation is not effected with certainty except during the repose of the organ. These general considerations apply more closely to the nervous system than to any other organ or tissue. The first condition of the recovery of a cerebral affection of this kind is the most absolute rest possible of the functions of the organ, particularly of those which have been exercised to excess. The patient should abandon his occupation and be kept free from all excitement; we should recommend moderate exercise in the open air and purely physical occupations.

Recovery is favored still further by a good general condition of health; we must excite the nutritive functions by tonic medication and vigorous regimen. Among the hygienic measures which contribute to stimulate the nutrition and are most useful for the happy issue of the cerebral manifestations of syphilis we must include hydro-therapeutics, which has a special tonic action upon the nervous system. Hydro-therapeutics should be used in the form of cold douches with a spray upon the trunk and limbs for ten to thirty seconds, during which time the head is kept covered with a cloth wrung out of cold water. This should be done once or twice, according to circumstances, but always at the same hour. Perfect exactness is one of the chief conditions of success in the treatment of the majority of functional disturbances of the nervous system, but it is especially demanded in the practice of hydro-therapeutics.

Epilepsy associated with hereditary syphilis should be treated in the same way as that due to tertiary syphilis. But as it often occurs in individuals whose constitution is impaired and who suffer from other disturbances, hygienic treatment assumes still more importance. Nevertheless the iodide treatment must be particularly insisted upon.

A certain number of epilepsies which are symptomatic of lesions that are susceptible of diagnosis cannot be subjected to rational treatment on account of the nature of the lesion.

Thus epilepsies due to tubercular neoplasms are beyond the resources of art because the growths are generally multiple. This is also true of those cases resulting from cancerous tumors that have developed in the brain, whether primarily or secondarily. It is equally true in cases of tumors of other kinds which are inaccessible on account of their site or cannot be removed on account of the large destruction of tissue which this would necessitate. The same reserve applies to epilepsies dependent on visceral or peripheral lesions which are themselves beyond the resources of treatment. We are then compelled to resort to palliative measures which are unfortunately of little use. Nevertheless we must not discard the chances offered by so-called specifics or antispasmodics, particularly by potassium bromide, which even in these cases may produce some relief. Tonics may also prove useful.

Ferruginous preparations have often been extolled in epileptics with enfeebled constitution. Hydrocyanate of iron has secured recovery at the hands of Bertrand and Jansion, and Delasiauve has obtained improvement. It is given in doses of one and one-half centigr. morning and evening, increasing by one centigr. every three days until ten centigr. are given at a dose. Tyrrell obtained some benefit from strychnia, especially in females. It may be assumed to act upon nutrition by stimulating the digestive organs. Other tonics, such as cod-liver oil, have also proven their value.

In addition to the drugs administered to meet certain morbid conditions in the epileptic, therapeutics has often taken theoretical considerations as a guide.

Ancient writers regarded epilepsy as frequent in vigorous and plethoric individuals, and did not hesitate to treat it by debilitating methods. Venesection has been reinstated in favor recently by Lépine, who has obtained several successful results in plethoric patients.

Surgery has often interfered not alone by trephining or by operations on the nerves and regions from which the aura appeared to start, but also with the object of modifying the cerebral circulation. Compression and ligature of the carotids and ligature of the vertebrals have been tried. In one case in which Velpeau had tied the facial and temporal arteries, the daily attacks were suspended. Marshall Hall recommended tracheotomy and tracheal fistula with the same object in view.

Corning relieved the crises completely by permanent compression of the carotids. Alexander has since recognized the inefficiency of ligature of the carotids, but as the congestive phenomena which accompany the attacks permit him to assume that the sympathetic plays an important part in their production, he did not hesitate to remove the superior cervical ganglion on both sides, and announces six recoveries among twenty-four operations. Judgment on this operation should be suspended. It does not appear to have caused death directly, but generally gives rise merely to a slight ptosis with narrowing of the pupil, which may readily pass unnoticed when the removal has been total on both sides and the effects are symmetrical.

The incisions of the scalp performed by Péraire and Anglade are intended to obliterate a certain number of arterioles of the encephalon and to diminish the congestion.

Daily application of ice (Chapman) to the spinal region or the præcordial region sometimes produces amelioration and even a certain diminution in the number of attacks in epileptics whose paroxysms appear to be connected with acceleration of the pulse and palpitation (Charcot).

Evacuants in the shape of emetics and purgatives, especially drastics, have also enjoyed a certain degree of favor. The use of purgatives is only justified when there is marked constipation with which we can associate an exacerbation of the attacks, and especially when there is reason to suspect the presence of intestinal worms. In children it is always well to produce an evacuation in order to make the diagnosis certain. Emetics should be abandoned entirely.

Issues, which were employed formerly for the purpose of evacuating peccant humors, appear to act mainly as revulsives.

Inunctions of tartar emetic, which have been employed either without any definite localization or upon the head, may be used like flying blisters. Blisters have often been applied, without any elective localization, to the neck, the arm, sometimes to the head. Leuret, who has used them, has seen only temporary improvement. Récamier cured an epileptic by pursuing, with flying blisters applied to the leg, thigh, arm, neck, trunk, a pain which was manifested before each attack in the shape of spasms of formication and numbness, and which successively occupied each of these various regions.

Bravais had already obtained similar success in cases of hemiplegic epilepsy, and Buzzard and Hirt have mentioned others; still more recent ones have been published by Pitres. The observations by Récamier, Hirt, and Pitres are particularly interesting in that they show the possibility of the transfer of the aura under the influence of an irritant—a transfer analogous to that observed frequently in the purely dynamic disorders of hysteria.

Le Breton obtained a suspension of attacks for three years by applying superficial cauterizations to the sinciput. Caustics have been often employed with doubtful results. Schroeder van der Kolk eulogized cutaneous revulsives on the head. Delasiauve repeated these experiments without notable results. I have also resorted to superficial cauterization of the scalp, but not indifferently over the entire surface. I applied the actual cautery irons very lightly two or three times a week, to the number of twenty, on that region of the skull which corresponded to the motor centres that appeared to be the site of the motor discharge. This may be done without shaving the scalp if care is taken to separate the hairs. These applications are generally well tolerated, as is shown in the following case of a patient who, although apparently cured, returns twice a week for treatment.

Case IV.—Epilepsy in a hemiplegic; treatment by actual cautery to the head; apparent recovery.

The patient is a man of thirty-two years, without a neuropathic history. He was of a gloomy character, and since his military service has indulged in alcoholic excesses. His wife has had four miscarriages, and the four children born at full term died in infancy in convulsions.

January 7th, 1885, when twenty-nine years old, attacked by left hemiplegia. In August of same year had first attack of epilepsy; neither in this attack nor the subsequent ones did he have any peculiar sensations on the hemiplegic side; the attacks recurred nearly every fortnight. In 1886 he had twenty-one convulsions and six attacks of vertigo. In January and February, 1887, he had four attacks and then came under my observation.

Patient is suffering from incomplete left hemiplegia, sensation not notably affected; the general health is excellent. The

convulsions are exactly alike; he thinks that surrounding objects are growing more distant; this idea causes mental distress and he then loses consciousness. At other times a mist passes before his eyes and he says that he is going to fall; on several occasions the attack was checked at this stage by striking him upon the shoulder. In the attacks of vertigo no other phenomena are observed. When the paroxysm is complete the entire body is convulsed. After the attack has intense pain in frontal region for remainder of day.

Until February 10th, 1887, had no treatment to combat the attacks. I then shaved his head in the right parietal region over a surface seven to eight centimetres in diameter, and applied, two or three times a week, ten to fifteen points of actual cautery, without giving rise to suppuration. Before this treatment he had had two attacks in January and two in February. Afterward the paroxysms became much less frequent. Until October, 1888, had only three convulsions at increasing intervals. October 8th, 1888, had an attack after alcoholic excesses. December 10th, vertigo without loss of consciousness. April 14th, 1889, left the service, but continues to come twice a week to receive the cautery. During 1889 had only one attack.

Local cauterizations also had good effects in a case of partial epilepsy and one of general epilepsy with facial hemiparesis. In eleven other cases in which the same treatment was adopted, only temporary amelioration was secured.

Several writers have proposed the application of the actual cautery to the cervical or spinal region. This method appears to be especially justified when there are painful points upon the spine.

Alexander recommends percussion of the spinal column with a wooden mallet whose blows are deadened by a disk of rubber.

CHAPTER IV.

TREATMENT.

ANTISPASMODICS.—EMPIRICAL AND SPECIFIC DRUGS.

THE drugs known as antispasmodics have long held a prominent place in the treatment of epilepsy. Camphor, despite the doubts which attach to its efficacy as an anaphrodisiac, is still recommended in the cases in which onanism seems to play an important part as an exciting cause of the attacks. Gallium enters into the composition of the secret remedy administered at the Teppe Asylum.

Ether has been administered by the stomach and by inhalation. Moreau, of Tours, has obtained only failures by the latter method, and has even seen prolonged inhalations give rise to attacks. There is reason to believe that ether and chloroform may excite epilepsy as they often excite hysterical attacks.

Nitrite of amyl has been sometimes used in daily inhalations, but generally with no effect. Bourneville has observed in several cases that it aborted the attacks, but he has not obtained the good effects reported by Crichton Browne in the condition of status epilepticus. The employment of nitrite of amyl, introduced into the therapeutics of epilepsy by Weir-Mitchell in 1872, appears to be especially justified on the theory of cerebral anæmia. It causes a diminution of tension in the peripheral vessels and produces intense congestion of the face and brain.

Opium and its derivatives may relieve the attacks momentarily, but they exert no influence on the course of the disease. Gabler has seen acute morphinism manifest itself by epilepsy, and in his lectures he recalled the case of a distinguished American physician who accidentally took fifteen grains of opium and in whom the effects of the poisoning were first shown by epileptic seizures.

In a case in which morphine in increasing doses had been

employed by the patient himself with success for a certain length of time, a fatal status epilepticus developed during a period of amorphinism.

As epilepsy without known cause rarely yields to so-called rational modes of treatment, the field was opened to empiricism, and even to-day it is rich in promises. The large number of specifics recommended shows their powerlessness and the resistance of the disease. We will mention only those which have enjoyed or still enjoy some credit.

Valerian has been recommended by Tissot, De Haen, Esquirol, who prescribed it in doses of an ounce to an ounce and a half, in powder or extract. Valerianic acid may be prescribed in doses of two to ten drops daily, but the best preparations are the valerianates (ammonia, zinc, iron, quinine, atropine).

Belladonna has been recommended by Debreyne, who claims to have had numerous successes, but his good results have not been obtained by others. It must be remembered, however, that Trousseau has vaunted belladonna in the treatment of one epileptiform manifestation, viz., nocturnal incontinence of urine.

I have tried belladonna several times in convulsive epilepsy with doubtful results, except in one case, in which there was manifest improvement for two months. Belladonna is given in the shape of extract or powder, in increasing doses; starting with gr. $\frac{3}{10}$ we increase by gr. $\frac{3}{10}$ every week until the physiological effects are manifested, viz., heaviness of the head, vertigo, dilatation of the pupils, hallucinations of sight, dryness of the throat, diarrhœa. It is easy to tolerate a dose of gr. iij. a day. The drug seems to be especially useful in the abortive forms of the disease. In a certain number of cases it appears, as Gowers has remarked, to form a useful adjuvant to potassium bromide. Hughlings Jackson thinks that the dose should be pushed to the production of dryness of the throat; he advises that it be given preferably at night, as he thinks that it particularly acts against nocturnal epilepsy. Atropine has also been recommended under similar conditions, as neutral sulphate or as valerianate, in doses of gr. $\frac{1}{150}$ in children and nearly gr. $\frac{3}{100}$ in adults (Michéa). Hyoscyamus and hyoscyamine have often been employed either in combination with belladonna or as a substitute.

Fluid extract of rhus aromatica, six to twelve drops twice a day, has been recommended against the nocturnal incontinence of urine in children. Graves had claimed some successes with cotyledon umbilicus (pills of gr. iiiss. up to nine a day).

Digitalis is still used frequently in England, chiefly as an adjuvant of potassium bromide. It is readily understood that it may act favorably by modifying the cerebral circulation, especially in cases in which there are functional disorders of the heart.

The compounds of zinc have enjoyed great repute in the therapeutics of epilepsy. Oxide of zinc may be given in gradually increasing doses up to 15, 30, 45 grains daily or even more, without causing any unpleasant effects except diarrhœa and nausea. Some patients do not tolerate the smallest doses, even if we begin with 1–1¼ gr. In children it is well to begin with ¾ gr. In certain cases it appears to be a useful adjuvant of the bromides, whose action it favors; and in some cases we obtain, with moderate doses, an improvement which had not been produced by the bromides. Oxide of zinc has often been given in Méglin's pills, which also contain valerian and hyoscyamus. Herpin has effected cures with this remedy at all ages, even in a man of sixty-three years. He prescribes as much as ʒ iss. daily. Other preparations of zinc (lactate, acetate, sulphate, valerianate) have been employed, but it is difficult to arrive at a conclusion concerning their real value.

Nitrate of silver has been used since the beginning of the century, and a certain number of successsful results have been attributed to it. In one case, in which the bromides, belladonna, and oxide of zinc had produced no effect, I obtained temporary improvement with a dose of gr. i. daily, but the symptoms resumed their usual course at the end of two months.

Cocculus indicus and its alkaloid picrotoxine seem to have been given with some excellent results. The tincture of cocculus indicus is given in doses of twenty to sixty drops, picrotoxine in doses of gr. $\frac{1}{30}$–$\frac{1}{6}$; in large doses it produces seizures. Planet claims to have obtained sixteen recoveries with doses of gr. $\frac{1}{40}$ daily.

Larrea announced that he had cured himself by the aid of simulo, but this remedy has been tried by Eulenburg, Hale White, and Allen Starr without any permanent effect.

The salts of pilocarpine were employed in the treatment of epilepsy by Challaud and Rabow. Bourneville tried the nitrate of pilocarpine with doubtful success. I have made several trials of chlorhydrate of pilocarpine with discouraging results.

Borax was used successfully by Gowers, Folsom, etc. Gowers recommends an initial dose of gr. xv. which may be increased to ʒ iss. in three doses. He mentions diarrhœa and an eruption of psoriasis as possible accidents. Among 22 patients to whom borax (gr. xv.–xlv.) was given, I noticed temporary improvement in only 3 cases. A large number of the patients complained of nausea and diarrhœa. In two cases there was an eruption of eczema; in one of them the borax had been given for several months in doses of gr. xxx., in the other in doses of gr. xlv. The eruption was located on the lateral surfaces of the trunk and on the arms, and did not yield until the drug was discontinued.

Ralfe has communicated to the London Medico-Chirurgical Society a certain number of facts which tend to demonstrate the efficacy of nitrite of sodium in mild status epilepticus.

Voisin claims to have relieved, by means of curare, the accidents which are secondary to epileptic seizures. But in the first place these accidents vary in the same individual and, on the other hand, the experiments of François Franck tend to show that curare merely modifies the muscular convulsions without influencing the internal (circulatory, etc.) phenomena. Moreover, the therapeutic trials made by Bourneville and Bricon have not given a favorable result.

To the list of useless remedies we may also add benzoate of soda, sclerotinic acid, and acetanilide. In a number of cases epileptic headaches have been relieved by antipyrine, which has had no influence on the frequency of the attacks. Lemoine has obtained good results when the attacks were connected with the menstrual period, in irregular paroxysms, neuralgias and migraines. Nevertheless, antipyrine must be given to epileptics with a certain degree of caution. In a child Tuczek observed epileptiform attacks, preceded by insomnia and vomiting, as the result of the administration of the drug. One patient, whose attacks are preceded by lancinating pains in the genitals and lower limbs for several hours, is relieved of the pain by antipyrine and sometimes the convulsion is not produced.

CHAPTER V.

TREATMENT.—THE BROMIDES.

In 1851 Locock first employed potassium bromide in the treatment of epilepsy; among 15 cases treated he obtained 14 successful results. The physiological action of the remedy has been studied carefully by Martin Damourette and Pelvet. "Our experiments," they say, "show that the action of the bromide is general and that it affects chiefly the nervous and muscular systems. It is an anæsthetic of the nerve centres and columns as well as of the mucous and tegumentary surfaces; it is a sedative of the muscular, digestive, urinary, and respiratory tracts.

"This double anæsthetic and amyosthenic property explains perfectly the effects of the bromides, without the necessity of assuming a specific localization of action. The well-settled action upon the great systems enables us to include, at a single glance, the entire therapeutic domain of the drug. Thus by its anæsthetic and amyosthenic action it attacks the most extensive and complex neuroses (epilepsy, chorea, hysteria, etc.), as it also combats the more localized neuroses (dysphagia, asthma, etc.) or isolated morbid phenomena, such as the pain of neuralgia, migraine, rheumatism, etc.

"In the same way its sedative action on the capillary circulation makes it effective in relieving hyperæmias of any situation and character. Finally, it is on account of this double action on the nervous and vascular systems that it is so remarkably useful in the major neuroses and congestive processes of the nerve centres, such as epilepsy and eclampsia, hysteria and nervosisme, chorea, etc. Such is the curative mechanism of potassium bromide in epilepsy."

According to G. Sée, the bromides diminish the reflex excitability of the cord without destroying it, diminish the functions of the cord by producing oligheny and not by a special

elective action on the nervous tissues; in addition, they stimulate the inhibitory centres.

The bromide of potassium is undoubtedly the most effective of the bromides, but in some cases in which it fails, the bromide of sodium, ammonium, or lithium may give good results. Finally, it often happens that the combination of these four or of the first three succeeds better than each single one.

Other bromide salts have also been used in the treatment of epilepsy. Bromide of camphor succeeds particularly in the vertiginous forms of epilepsy and in the status epilepticus. The bromides of arsenic, calcium (gr. vij.–xxx.), zinc, nickel, gold (gr. $\frac{1}{8}$) are given like the other bromides and are sometimes effective, but we cannot rely upon their action. Bromide of ethyl has been extolled as an anæsthetic given in daily inhalations, but it does not seem to have clearly modified the course of the disease.

The bromide should be free from foreign elements (traces of iodides, chlorides, etc.) and should be given by the stomach. When given fasting it sometimes causes cramps in the stomach; when given too near the meals it interferes with digestion and is often tolerated with difficulty. The best plan is to administer it at the beginning of the meals. The prolonged contact of the remedy with the teeth may excite dental caries, which may be prevented by carefully rinsing the mouth after the administration of each dose.

We cannot expect a therapeutic action until the medicine has produced its physiological effects; lassitude, somnolence, anaphrodisia, suppression of the reflex nausea produced by mechanical irritation of the base of the tongue and the pharynx. The latter sign is, in a measure, the criterion of the condition of saturation, which it is useless to exceed and which must be maintained so long as recovery is not assured. It may be said, however, that recovery is never assured, and, as Voisin has well said, bromides should remain almost a food for the epileptic who has recovered. When the attacks have ceased for one or two years, we may attempt gradually to discontinue the bromide every third day, every second day, or one week every month, as Legrand du Saulle has proposed. In every case it is well to assure ourselves of the absence of reflex nausea. If the bromide has suppressed the attacks it should be continued so long as it is tolerated, and if the patient dis-

continues its use he must be told that it is at his own peril. He must be informed that when epilepsy has been checked for a certain length of time by the drug, it may happen that if the drug is discontinued the disease may return in an acute condition in the form of status epilepticus.

The dose varies considerably, according to the age and constitution of the patients. Gowers mentions cases in which a dose of gr. v. has been sufficient in children of 8 to 10 years. Such facts may give us hope of spontaneous recovery at this age, but in the majority of cases we must not lose time by trying small doses, and must remember that the older the disease the less its chances of recovery. Children of 4 to 5 years tolerate gr. xxx., xlv., or lx., and those of 10 to 15 years tolerate nearly as much as adults. In the adult a daily dose of ʒ iij. constitutes a maximum which need hardly ever be exceeded. It must be noted that the cases which yield most satisfactorily yield to moderate doses of ʒ i.–ij.

The bromide is prescribed in constant or alternating doses. In the first event the same dose is given every day; in the latter event we give progressively increasing doses (a weekly increment of gr. xv.) until, for example, we have advanced from ʒ i.–ij., then begin again at ʒ i., and so on (Charcot).

Instead of giving the bromide in interrupted doses every day, the English sometimes give it in one large dose every second, third, or fourth day. The patient then takes ʒ iv., v., vi. at once, generally with the meal. The tolerance of such large doses is not surprising. Puche had observed long ago that as much as ʒ x. may be taken in a day without bad effect. Several times I have tried these massive doses in epileptics who had been in the habit of taking ʒ 1¾–2 a day in two doses, and have seen frequent cures. Some of them tolerated a dose of ʒ 3, 3½, 5, every second or third day with a diminution of the attacks (without any change in the total amount of the drug absorbed), but in two cases bromism resulted, although it had not developed before the change in the mode of administration. The respective value of these different modes of administration cannot yet be settled.

The bromides act upon all forms of epilepsy, upon the psychical forms, the painful forms (migraine, ophthalmic migraine), as well as the external and internal convulsive forms.

It is difficult to determine the absolute frequency with

which it acts in ordinary epilepsy. The number of cases in which we can administer the bromide in a systematically progressive manner is relatively small, and for the majority of non-hospital patients the data are often insufficient, while it is difficult to take into account the effect of exciting causes.

One of the most interesting tables of statistics is that of Hughes Bennett. Among 300 cases treated by the bromides of potassium and ammonium, 12.1% had no attacks during the entire course of treatment; in 83.3% there was a diminution in the number and severity of the attacks; in 2.3% there was no change; 2.3% exhibited an increased severity.

Among 207 cases reported by Legrand du Saulle there were 110 unsuccessful cases, 19 cases of improvement, and 78 in whom all symptoms remained absent for a period varying from 6 months to 4 years.

Forty-five hospital epileptics—these are generally recognized as incurable—have been under constant supervision during the years 1886 to 1889, during which time they were subjected uninterruptedly and exclusively to the bromide of potassium. These have furnished the following results:

1886.		1887.		1888.		1889.	
Attacks.	Vertigo.	Attacks.	Vertigo.	Attacks.	Vertigo.	Attacks.	Vertigo.
4261	2339	2377	2882	2195	1365	1660	902

When the bromide does not succeed alone it may be combined with other drugs, such as belladonna, chloral, valerian, salts of zinc, which often serve as valuable adjuvants.

Ball extols a combination of bromide of ammonium and sodium with belladonna and oxide of zinc.

When the bromide has been found to be efficient, its administration may not be discontinued or even diminished without the greatest precautions. It has been truly said that the bromides remain a food for cured epileptics. Premature suspension or diminution of the drug may not alone compromise recovery, but may even endanger the life of the patient. It is not uncommon to find that a patient who, under

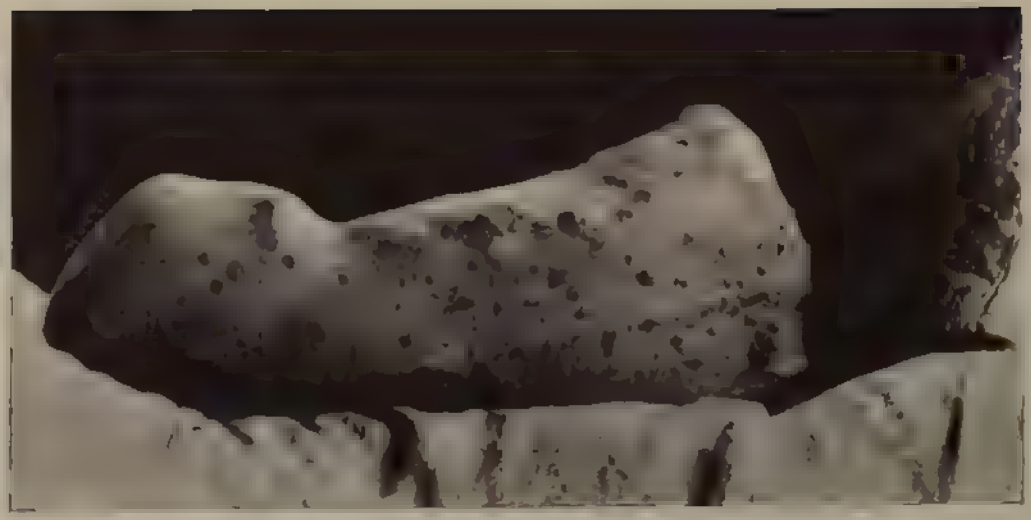
the influence of the bromide, has not had an attack for a long time, will suffer from a series of attacks or status epilepticus on account of an interruption in the administration of the drug. Hence the bromides should not be discontinued under any pretext during the course of effective treatment, except in a case of acute adynamic disease in which it is distinctly contra-indicated.

The drug is often repugnant to the patients because it gives the breath a peculiarly fœtid odor; it also causes somnolence, mental slowness, and diminishes or extinguishes the sexual functions. Some authors charge it with aggravating the natural irritability of the patients and of being able to produce attacks of mania. I believe, on the contrary, with Legrand du Saulle, that the bromide has a salutary action upon the character of epileptics, that it often makes the most irritable mild and tranquil, and that it suppresses the periods of excitement. As Legrand du Saulle expresses it, the bromide suspends epilepsy and disarms the epileptic. If the psychical manifestations of epilepsy are sometimes developed for the first time during the course of the bromide treatment, it is often due to the fact that the drug has produed a transformation of the discharge.

I do not deny, however, the impossibility of the development of maniacal excitement under the influence of the bromide. I will even admit that I have seen several patients in whom the paroxysms were evidently increased and aggravated under the influence of the bromide treatment. Apart from these accidents, bromides may also give rise to true poisoning, either in an acute or chronic form.

Acute bromism is manifested under two forms: drunkenness and stupor. It is generally admitted that bromic drunkenness differs from that produced by alcohol or opium, inasmuch as it exhibits only the stage of depression. Nevertheless, some individuals experience the phenomena of stimulation with small doses, while the larger doses have a manifest depressing effect. This is a very common feature in the history of drugs. Bromic intoxication consists of a more or less marked condition of exaltation, with anorexia, redness of the tongue, headache, and extreme irritability, which disappear quickly after discontinuance of the drug. At other times after a period of temporary excitement, which may even pass unnoticed, the

BROMINE ERUPTION OF THE FACE.



BROMINE ERUPTION OF THE DORSAL REGION

patient grows dull, complains of a dull headache, exhibits a repugnance to move, anorexia, constipation, a marked catarrhal condition ; the limbs grow weak and tremble under the weight of the body, the hands are awkward, speech is embarrassed, the gaze becomes dull, the face puffy and expressionless on account of the general flaccidity of the muscles, then the patient falls into a sort of coma from which no stimulation will rouse him. The respiration becomes slower, the pulse very weak, and it is probable that death would ensue did we not interfere. When suspension of the drug is insufficient, we must resort to drastics in order to produce rapid elimination through the intestines. In the two cases of this kind which came under my observation, recovery occurred in one or two days.

Slow or chronic bromism is characterized by a condition of depression. The face is pale, the mucous membranes dry and discolored ; there is gradual emaciation and the muscles are flabby ; the face loses its expression and exhibits hebetude, finally a veritable stupor; the limbs grow weak, sensibility is blunted, the memory and intelligence impaired, digestion poor, the breath very fœtid, the respiratory passages become congested, and the patient often succumbs with the symptoms of an adynamic pneumonia. This form, which corresponds to the depressive form of acute bromism, may recover under the same treatment. It is in this form of bromism that Voisin has observed a general delirium with violence which, when associated with difficulty in speaking and weakness and tremor of the limbs, may resemble paralytic dementia.

In certain cases of bromism the nutritive functions are particularly affected and a general cachectic condition results with emaciation and atony. This condition may be relieved by the administration of tonics, iron and quinine, and especially by hydrotherapeutics. Voisin recommends iron to relieve the anæmia resulting from the prolonged use of bromides. I am in the habit of prescribing the perchloride in doses of 4 to 8 drops, twice a day before meals.

But the most frequent disturbances are the cutaneous manifestations, and these may develop even though nutrition does not appear to have been much impaired. These disorders are presented in the following forms: 1. Disseminated acne, which exhibits no peculiarities except the dark red color, the

confluence on the face, back (Pl. 1 and 2), arms, and legs, chiefly upon the dorsal surface, where it often leaves cicatrices which remain pink for a long time. Bromic acne is often produced at the onset of the treatment, and may be prevented by the concurrent exhibition of arsenic. The bromide of arsenic, which has been suggested as preferable for arthritics, antagonizes in part this effect of treatment, but it is less efficient than the bromide of potassium. 2. The conglomerated bromic eruption is characterized by indurations in the shape of oval tubercles or elongated patches which develop in the thickness of the skin, and at first produce no change in the color of the integument. But gradually they assume a slaty violet color, when the indurations become confluent and form aggregated patches, or, despite their isolation, they assume large dimensions, form hemispherical projections from the surface of the skin, ulcerate and suppurate. This results in large ulcerated patches with irregular losses of substance, surrounded by a violet border, and between which are islets of integument of a normal color. Such patches present a very characteristic appearance, and are found mainly on the anterior surface of the legs, but sometimes on the forearms and other parts of the limbs, and even upon the face. The eruption is sometimes symmetrical, and is sometimes limited constantly to the same region in the same individual. In one of my patients the eruption has been confined, on several occasions, to the left parietal region.

In arthritic subjects the bromide very often gives rise to the appearance of dartrous eruptions, eczemas which by no means form an evidence of saturation. Eruptions which resemble erythema nodosa or urticaria, and which are accompanied by muscular or even articular pains, have sometimes been attributed to the bromides. It is especially in arthritic subjects that arsenic has a prophylactic action against the cutaneous eruptions induced by bromism. The use of arsenic against bromism is indicated so much the more because some writers have reported curative effects from this drug in epilepsy.

A certain number of patients who are subject to bromic eruptions after small doses or moderate doses of gr. 45–60 have no eruption when the dose is increased to 3 1¾, 2, 3. If the eruptions increase with the dose, they offer a serious obstacle to treatment, because usually they do not yield except after complete cessation of the bromide. In order to

prevent the cutaneous symptoms, the skin must be kept as clean as possible. I attribute the rarity of these phenomena in my wards in great part to the frequency of the baths.

In certain patients the bromide causes an abundant and disagreeable salivation, which may be combated successfully by means of tannin and hyoscyamus. At other times it induces a dryness of the throat and respiratory passages which gives rise to incessant cough and may arouse the suspicion of beginning phthisis.

One of the best means of preventing the accidents of bromism is to stimulate the urinary function by giving diuretics or diluents. Milk cannot be recommended too highly. Cheyne claimed to have cured epilepsy with the aid of milk alone.

Although the bromide sometimes causes impairment of nutrition and intellectual weakening, this result is not so common as is generally believed. When the drug really counteracts the epilepsy, when it diminishes the paroxysms in number and intensity, far from causing emaciation and mental impairment, it acts as a veritable restorative, both from a somatic and psychical point of view.

When the bromide does determine a profound debility, it may induce diathetic manifestations of all kinds which do not belong properly to the intoxication. On the other hand, when an infectious disease develops in a bromized epileptic, it has a great tendency to assume an adynamic or typhoid character.

The bromide administered during pregnancy does not interfere with the development of the fœtus or with the puerperal condition. On the contrary, pregnancy constitutes an indication for the use of bromides in epileptics. If the drug does not act upon the mother, there is reason to believe that it may exert a good influence on the product of conception.

In cases in which the bromide was poorly tolerated by the stomach, an attempt has been made to administer it per rectum or by hypodermic injection, but both plans have failed.

Doyon has studied the accumulation of bromide of potassium in the organism. His investigations were made upon an epileptic child who had taken bromide in large doses for a year, and who died after a scarlatina. Nothing special was found at the autopsy, but the chemical analysis showed that the brain contained nearly gr. xxx. of bromide and the liver gr. x. Taking into account the difference in the weight of

the two organs, we see that the brain contains a much larger proportion of bromide than the liver. From this comparative analysis it may be inferred that potassium bromide accumulates by preference in the central nervous system, and this is not surprising in view of the fact that its physiological action is exerted mainly on these centres. This investigation, however, does not teach us the moment at which the accumulation of the drug in the nervous system becomes dangerous.

But the accidents attributable to bromides are of relatively little importance compared with the services which they render in epilepsy, under whatever form it is presented. If the bromide of potassium has been more accused than other drugs, it has also been of greater service, and its utility would be still more apparent if the observations of cases which it has cured outside of medical supervision could be collected with more accuracy.

CHAPTER VI.

TREATMENT.—PHYSICAL AGENTS.

THE physical agents employed against epilepsy are, in the main, electricity and hydrotherapeutics. We have seen that hydrotherapeutics may be a useful adjuvant to antisyphilitic medication, and it may also play the same rôle with bromides and the other drugs whose action has been recognized by experience. In a certain number of cases hydrotherapeutics unaided seems to have had a favorable action. To Fleury belongs the credit of having first treated epileptics methodically by douches administered according to his method. This consists in giving simultaneously the douche in shower and the douche in jet to the posterior surface of the body for 15 seconds, then the douche in jet for 15 seconds, and finally the douche to the anterior surface for 30 seconds, the entire manipulation lasting one minute. Hydrotherapeutics alone does not seem capable of effecting a cure, except in cases which developed accidentally after errors in regimen or intense emotions, cases in which spontaneous recovery is possible. In some patients it diminishes the number of attacks; in a large number it exerts a favorable influence on the general condition.

Electricity has been employed chiefly in the form of the constant current.

Althaus recommends transverse galvanization through the mastoid processes and galvanization of the sympathetic. Erb employs the following method: an oblique current through the head from the temporal region and upper part of the forehead (positive pole, large electrode) to the opposite side of the neck (negative pole); constant, very weak current for a half minute on each side; then a current is passed, for ½ to 1 minute, from the forehead to the back of the neck.

Fischer advises general faradization, which is also recommended by Rockwell. The latter also employs central galvanization at the same time.

Magnets have also been employed against epilepsy since the time of Paracelsus; the experiments of Bourneville and Bricon were attended with entirely negative results.

A certain number of cures of epilepsy have been attributed to mental excitement. But in the cases in which such influences have had an especially manifest action, we are justified in assuming that we have to deal with hysteria. It must be noted, however, that a traumatism sometimes appears to have been the cause of recovery. Cazenave mentions a patient who recovered from epilepsy after the amputation of a leg which was affected with gangrene. Banks Whitcombe has reported a similar outcome after an amputation of the thigh.

It need not be said that suggestion has been employed in epilepsy. In Bernheim's work on suggestion we find a case reported under the heading "abortion of an epileptic seizure and entire cure by suggestion." But on reading the case we find that he speaks simply of epileptiform attacks which are not otherwise described, and with regard to the abortion of the attack we find the following: "On the morning of the 21st he felt a dulness and pain in the head, visual obscuration, slight twitchings in the limbs; these are the premonitory symptoms of the attack. I hypnotized him in bed at 10 A.M. and suggested to him to sleep quietly until 5½ o'clock P.M. without the slightest convulsion. He awoke at the hour mentioned; at 2 o'clock, during his sleep, he had a few lively twitchings in the arms and legs and uncovered himself in bed, the entire twitching lasting a second; but the attack did not occur—it was aborted." I see, indeed, that the twitchings occurred, but I do not see that the attack was aborted. The case was simply one of "epileptiform" seizures after a cranial traumatism, and the former may have disappeared spontaneously with the other symptoms.

Whatever may be the deception due to the partial or temporary improvement that follows any change of treatment, such improvement must not be underestimated. As Tissot has well expressed it, the important point to combat is the epileptic habit. Whatever interrupts this habit, even temporarily, improves the prognosis in a certain measure. All rational and empirical methods which have been attended with good results should be tried if the general condition warrants.

Some special symptoms may be amenable to physical agents.

Headache is sometimes so intense in epileptics as to be insupportable and to lead them to ask for the operation of trephining, an operation which has been employed with success against this symptom.

I have several times resorted to a milder procedure, viz., compression. Compression of the nerves in certain neuralgias,

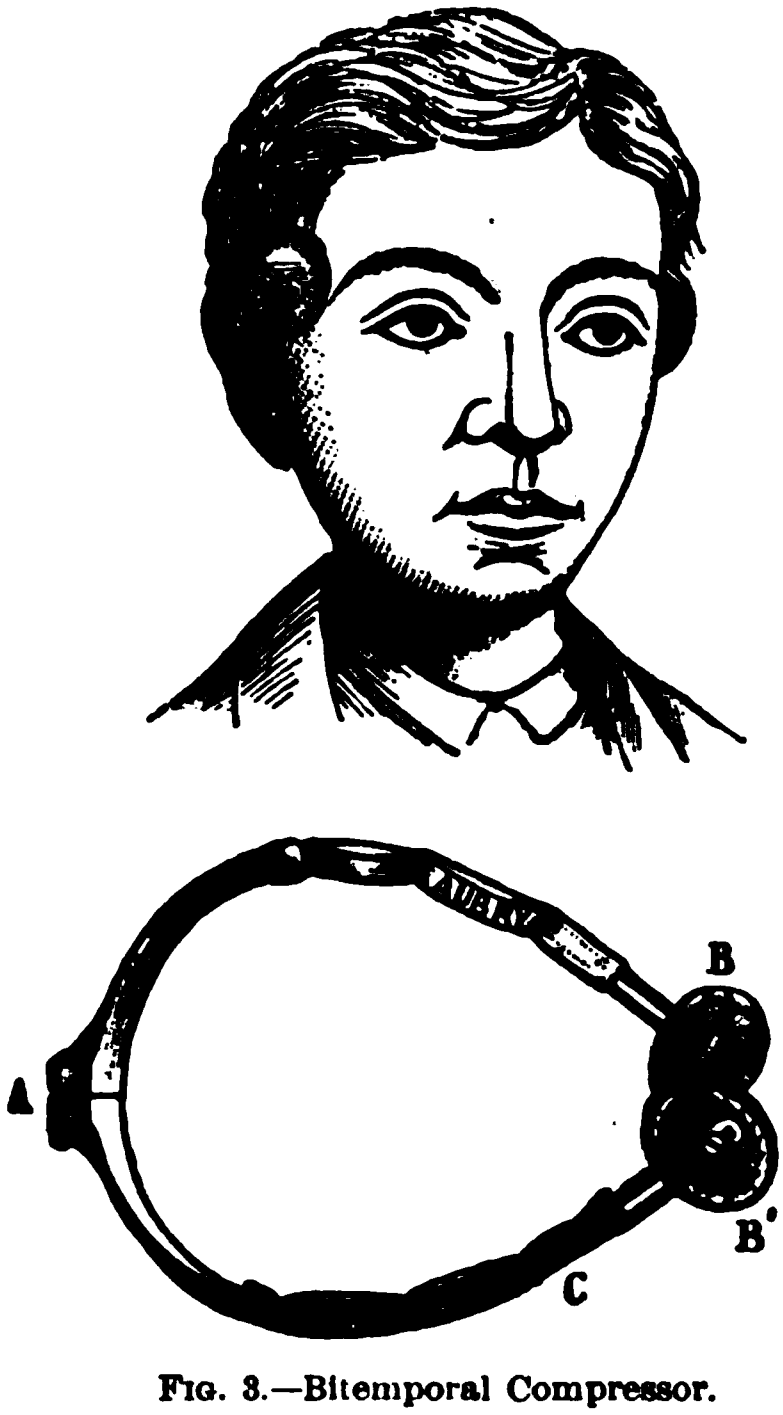


FIG. 3.—Bitemporal Compressor.

particularly in sciatica, has been tried with more or less success. But in one kind of pain, viz., hysterical and epileptic cephalalgia, it has been especially useful. Patients suffering from such headaches are often seen to assume the strangest attitudes in order to be able to produce effective compression. A large number of patients resort to manual compression, but in all cases the manipulation has only a mechanical action. Briquet, who had recognized its efficacy in hysterical cephalalgia, recommended permanent compression by means of a

circular band. But this kind of compression cannot be applied to all parts of the head. When the pain is bitemporal, as happens very often, we may be compelled to use a spring apparatus such as is shown in Fig. 3. Compression with the band presents the inconvenience of being applied with difficulty by the patient himself. I have devised an apparatus which I have often used (Fig. 4) and which avoids these inconveniences ; it appears to me to be very simple and capable of application in a large number of cases. It consists of a cap with double walls, divided from the crown to the rim by radiating seams, which form spaces about one centimetre wide near the

Fig. 4.—Compressing Cap, Loaded with Lead Shot.

periphery. These spaces are filled with shot, which may be distributed uniformly or in different ways, according as the compression is to be general or to bear more markedly on a special point. It fits perfectly on account of its weight and moulds itself upon the parts. The cap used in my wards is weighted uniformly with 4½ pounds of No. 10 shot. As a general thing the patients only wear the lead cap for a short time, sometimes for a quarter of an hour, rarely for two or three hours a day. A few, however, wear it constantly and can work without any inconvenience. After a certain number of applications the pain often diminishes and disappears without returning. In a number of cases the epileptic attacks were

modified temporarily under the influence of the compression, and their number was permanently diminished. In two cases the attacks continued less severe for several weeks; in one they were no longer accompanied by complete loss of consciousness, in the other the involuntary micturition ceased.

The disturbanecs of sleep merit special attention. Insomnia and nightmare, which are so distressing in themselves, may constitute a condition that is favorable to the occurrence of attacks. Chloral hydrate, belladonna, and sodium nitrate have been proposed against these symptoms, but they often persist because they are the result of a physical condition against which hypnotics are powerless. The peripheral circulation is often remarkably slowed in epileptics. The extreme parts of the body, the feet, hands, nose, ears, are the site of a true cyanosis, and when the external temperature is low they assume a very characteristic violet-blue appearance. This disturbance of circulation is often accompanied by very distressing coldness of the parts, and is capable of producing insomnia. Epileptics, who are usually very sensitive to cold, must be very warmly clothed, especially at night.

CHAPTER VII.

HYGIENE, REGIMEN, ASSISTANCE.

SOME general hygienic measures are of great assistance in the treatment of epilepsy. Since the time of Hippocrates a change of climate has been recommended. When the patients are no longer under our eyes we may yield to the illusion that they are better, but the efficacy of a change of residence is far from being demonstrated. We can hardly advise travelling for epileptics. The frequent change of scene, the varied excitements, the slightest annoyances in travelling may be the cause of renewed outbreak of the attacks. Trips into mountainous regions, involving at times violent efforts, rapid changes of temperature, prolonged exposure to the sun, are necessarily injurious. It is hardly necessary to remark that the risk of accidents of all kinds is increased by travelling.

On the other hand, exercise in the open air is generally beneficial to epileptics, but the exercise must be moderate in degree. In my wards I have a patient, suffering from hemiplegic epilepsy, who furnishes a very interesting illustration of the effect of violent exercise. During dynamométric examination of his strength when I tell him to grasp the instrument with the sound hand suddenly, he loses control of the movement, when he reaches the extreme limit of his strength; the contraction of the hand becomes permanent, is accompanied by tremor which extends first to the face and lower limb of the same side, then becomes general, and loss of consciousness follows. Laborious occupations sometimes give equally decisive results; on several occasions I have seen a change of occupation give rise to a modification of the number of attacks which did not appear to be susceptible of any other explanation. Agricultural labor seems to be especially advisable. Monotonous work which does not necessitate close attention and is performed automatically at regular hours also appears to be favorable. The same remarks hold good

with regard to recreation. The worst exercises are those which require sustained attention and violent effort, such as fencing. Kerlin has made the interesting remark that young epileptics rarely have an attack while playing. Prolonged attention alone is often sufficient to excite an attack. I have very often seen attacks produced in patients who had been "discharged" by a recent paroxysm, when they were subjected to a careful examination of one of the organs of special sense. Certain explorations which demand an effort in order to secure immobility—for example, laryngoscopic or ophthalmoscopic examinations—also provoke attacks.

It is unnecessary to say that a certain number of vocations and bodily exercises must be absolutely interdicted. Epileptics must not be exposed to the danger of fire, water, a fall from an elevated place, etc.

Our remarks on the dangers of exercises which require sustained attention should also be a warning against intellectual efforts in which a great exercise of the mind is requisite. It is rare that embarrassed affairs and constant preoccupation, of whatever character, do not aggravate the disease. All forms of instruction or mental labor which require "cramming" cannot be otherwise than prejudicial to epileptics.

The diet of epileptics needs no special consideration. It is true that digestive disorders favor the development of spasmodic disturbances, but their prevention constitutes a general hygienic measure, without any special indications as regards epileptics. Although stimulating diet, and especially alcoholic drinks, is capable of exciting epilepsy, still a generous diet is necessary for epileptics unless, as rarely happens, they exhibit a clearly plethoric constitution. The necessity of a strengthening and even excessive diet is, moreover, indicated by the fact that a large number of epileptics are feeble, anæmic, suffer from scrofula, or are predisposed to tuberculosis, to which they often succumb in the end.

Hughlings Jackson thinks that epilepsy results from a modification of the nutrition of the gray substance of the brain; the phosphorus is no longer present in the ordinary proportion and is replaced in equal amounts by nitrogenous substances which render the nervous tissues more explosive. A special regimen has been deduced from this conception.

When epileptics were subjected alternately to a nitrogenous diet and to a farinaceous diet to which ten drops of phosphorated oil daily were added, the attacks diminished under the influence of the latter plan.

The quality and quantity of the food of epileptics, as well as the regularity of the meals, should be the objects of constant supervision. All dyspeptic disorders are capable of exciting paroxysms, either directly, or indirectly by interference with sleep.

Epileptics should be removed as far as possible from the struggles of life. They are incapable of maintaining the battle under ordinary conditions. This does not imply that all the enjoyments which they may desire and which they may be incapable of acquiring should be freely given to them. But it is necessary to aid them in utilizing their feeble means and to create for them an environment in which they will not suffer from their infirmity and in which life will be regulated by an authority so firm that the idea of rebellion will not arise. Epileptics who live among people of the same degree of education suffer constantly from the relative inferiority to which their malady reduces them. They are more content among persons of an inferior condition, who tolerate uncomplainingly their irregularities and their demands without making them feel their morbid degeneration. From this point of view there are advantages in placing epileptics among strangers.

We must not allow epileptics, young and old, to forget that they must be subjected to general rules. Alhough it is possible to spare them certain constraints and obligations, it is necessary that they remain convinced that they are the subject of measures of benevolence. The exceptional laws which protect them under some circumstances procure for them immunities which are more apparent than real, and in the end they must always endure the consequences of their sad affliction. Too great complaisance toward them can only compromise their already precarious position.

The education of epileptic children presents the greatest difficulties. Their excessive impressionability, their brusque changes and impulses, their depraved instincts, must be combated with the greatest care. We must act toward them in such a way that they are convinced both of the kindness of

those around them and of the inviolability of necessary laws. We must not inculcate in neuropaths, to which category these patients belong, the illusion that their infirmity constitutes an advantageous distinction. This illusion, which aids in sustaining those who are not kept within bounds by appreciating their condition, but who believe they have the right of determining their own responsibility, cannot be otherwise than disastrous to the patients, because nature has proclaimed the law "unhappiness to the infirm" and no sophistry will prevail against it. The degenerate of all kinds have only one means of rendering this less inevitable, and that is by doing the little of which they are capable, in order to make themselves as useful as possible.

The somatic phenomena which accompany the intellectual manifestations justify the notion that the intelligence is a function of the nutrition. We can no longer admit that good or bad impulses come from heaven or from hell; they are the product of good or bad organs. We cannot expect that moral formulæ will modify the function of defective structures. We can only interfere usefully by physical agents

Pleasure and pain are the sole springs of action in all animals. It is only by their association with agreeable or disagreeable sensations that we assume the habit of calling actions good or bad, according as they are useful or harmful to the greatest number.

This association is realized with so much more facility in the nervous system according as the painful or agreeable sensation is more exactly synchronous with the harmful or useful act—*i.e.*, the punishments have so much more chance of effecting their purpose when they appear immediately after the act which has provoked them. Those engaged in the training of domestic animals have long since recognized the importance of this principle. It is at the moment when the fault is committed, says La Guéitinère, that the punishment should intervene, because otherwise it is more dangerous than useful. The chastisement should ensue not alone at the moment when the fault is committed, but preferably at the instant when it is about to be committed. All professors of riding agree that it is always unwise to take into the stable an unruly horse who has failed in an evolution, because he associates the faulty movement with the agreeable impression of the return to the

stable, and the tardy punishment is not associated with the fault which is already forgotten. Brutality must be avoided, but inflexible firmness, united with patience, is necessary in the education of degenerates of all kinds. It must not be imagined that their obtuse or perverted faculties engender an absolute impossibility of comprehending the necessity of obedience to rules. As Calmeil says, "The walls of an asylum are in themselves an effective measure against insanity." We know, in fact, that the most violent yield, in a measure, to the necessity of obedience; epileptics do not escape this rule. It is not alone in the intervals between the attacks that epileptics are capable of proper reaction to discipline, but it is found not infrequently even in an epileptic crisis that a patient responds to a brusque and vigorous question and obeys a command. We must not fail to make them respect necessary laws.

This principle does not exclude tenderness; the iron hand in a velvet glove is always indicated in the case of such patients. It must not be forgotten that all distressing emotions are especially prone to excite epileptic paroxysms. Children are particularly subject to such causes of irritation. Herpin reports the case of a young epileptic who was allowed to indulge in marked eccentricities at school and was taken home wearing a fool's cap; he was greatly mortified and had eight attacks the following night; on the following day he was very sick and excited. Numerous illustrations of the same kind might be quoted. One of my patients had a series of 25 attacks after having been kept in a dark room for an hour.

Young epileptics as well as adults should be closely watched with regard to the hygiene of the sexual functions. In a general way sexual excitement is injurious to epileptics, even to those who are apparently the most vigorous. They should be kept away from causes of sexual excitement as much as possible, and conjugal relations, which can only have deplorable results, should be interdicted almost entirely. The genital organs should be examined in order to make sure that they are not the site of any cause of irritation; in children local irritations are often the source of bad habits. Yet it must be remembered that masturbation, which is so frequent in idiots and epileptics, is rather the result of their cerebral defects than of bad education and lack of supervision. Under some

circumstances, circumcision, which has been extolled as a hygienic measure, may suppress one cause of irritation and thus improve the epilepsy. But we must not expect too much from this measure.

On January 1st, 1878, Lunier calculated the entire number of epileptics in France at 33,225 ; about 1,650 so-called simple epileptics were in hospitals or treated in special institutions, 3,550 insane epileptics were retained in asylums, and about 28,000 were kept at home by their families. Lunier thinks that of these 28,000 about 10,000 should receive hospital treatment. Burlureaux states that from 1831 to 1853 the conscriptions showed an almost constant proportion of epileptics (16 : 10,000). Even if the number has remained stationary, it is certainly very great, and constitutes a social problem which is not lacking in interest.

Epileptics are incapable of following a certain number of pursuits in which they are constantly exposed to dangerous falls. In others they are obliged to give up the work, either because they are surprised by the attacks in the midst of the work or because nocturnal attacks make them forget the hour to begin work, or they are left in a stupor so that they are unable to leave the bed. When they fall during the day in the workshop, the store, or the office, they become an object of horror, and are often discharged although still capable of doing their work. Apart from the convulsive seizures they are subject to alternations of excitement and depression, they are often mistrustful and difficult to live with ; in a word, their character does not offer compensation for the annoyances connected with their convulsive disturbances. When psychical disorders make their appearance, whether in association with the attacks or apart from them, it often happens that the epileptics, although still capable of sufficient work for self-support, are unable to utilize their resources and fall to the charge of their family or the public.

When they remain idle, the attacks often increase in consequence of the vexations and privations which result. Ere long the epileptic ought to be the object of constant surveillance. Not alone has he become incapable of producing anything, but he paralyzes useful forces and becomes a source of ruin to his family.

If misery is the fate of inoffensive epileptics and often of

their families, the situation of those who suffer from more or less permanent mental troubles is often worse until they are recognized as dangerous to themselves and to the public safety.

Dangerous epileptics should be sequestered—*i.e.*, kept in special hospitals under the responsibility of the superintendent. But what is a dangerous epileptic? The definition is less difficult than appears at first sight. A dangerous epileptic is a patient who has committed harmful acts or exhibits a violent conduct, and cannot be prevented from producing injurious results except by force.

This imperfect definition implies the existence of two categories As regards epileptics who have committed harmful actions under the influence of their morbid disorder, there can be no doubt. Their crime sufficiently establishes the fact that they are affected with a morbid and dangerous irritability and that they have not found, in their surroundings, a sufficient protection from their bad instincts. Society should, then, guard itself against them by placing them under conditions in which they can no longer commit a criminal act. These measures should be perpetual, inasmuch as no objective fact enables any one to affirm that an epileptic is cured. We should not permit their liberation, even under bonds.

As regards violent epileptics who have avoided the commission of crime only as the result of accident or the interference of another, it may be said that physiologically they are not distinguished from the first class. But it is necessary to distinguish them from the social point of view, because the law does not recognize a crime in intent and cannot liken a criminal intent to a brutal act, often without motive or demonstrable premeditation. If these can be sequestered at the request of their family or by public authority, it can only be for the purpose of protection against a possible, but not demonstrated, danger. When their disease has been modified, either spontaneously or under the influence of proper treatment, so that they no longer exhibit any disorders which necessitate interference, they may be restored to their former condition if they are capable of providing for their wants or their relatives will be guarantees for their conduct.

Can it be affirmed that an epileptic is not dangerous? The affirmative cannot be maintained in a general way. It cannot be said that such and such an epileptic is and will re-

main inoffensive, but he should be regarded as such so long as he has committed no overt act. Among these mild epileptics an important group is formed by those who are incapable of providing for their own wants or defending their interests, either because they have frequent attacks or the latter are followed by mental obtuseness or various intellectual disturbances. A certain number suffer from imbecility or idiocy, others from permanent mental disorders. These patients are generally kept in lunatic asylums; in my opinion this is their proper place. In large asylums in which epileptics are very numerous, it may be advantageous to collect them in a more or less isolated special ward, but I do not think it is necessary, as has been advocated, to erect special asylums for them.

As regards epileptics with rare attacks who are free from serious mental disturbances and who are not compelled to abandon their vocation except on account of the repugnance which they create in those around them, I think there is no need of placing them in a hospital. For these epileptics, assistance while at liberty is as well as and perhaps even better than in the case of so-called inoffensive insane. A large number of epileptics in this category will be sufficiently assisted if we procure for them the means of pursuing their occupation in an environment which is cognizant of their infirmity and interested in tolerating them. Many are capable of benefiting by the family patronage which is practised in Belgium and Scotland.

The object of assistance consists not in maintaining the misery by the blind distribution of alms, which serve rather to propagate than to extinguish pauperism, but to cure the misery at its source by procuring for the disinherited ones the means of utilizing their powers.

A certain number of epileptics could live under the medical supervision of asylums in colonies established in their vicinity, and more or less similar to that which has been established at Bielefeld, in Westphalia.

The history of this colony is especially instructive. Its beginnings were extremely modest. Four epileptics had been placed in a cottage and little by little their number was increased. In a few years several hundred epileptics found an asylum in similar lodgings established in the vicinity ; in 1885 there were 800 patients, who supported themselves almost

entirely. Less extensive aggregations would be preferable, and it is especially necessary to place the patients under medical supervision.

The private asylum of Teppe, which has been compared to the colonial system, is really an asylum with open doors under the direction of nuns. On account of the relations which the inmates hold it is impossible to regard the establishment as one for the utilization of epileptics (who are treated by a secret remedy).

In the absence of proper institutions, epileptics who suffer only from convulsions, but who are infirm at the same time, while not insane in the legal sense of the word, should be kept in hospitals and not in asylums where their presence would be contrary to law. It should be noted, however, that a large number of these patients, as well as their families, connive at this illegality. Not being able to find assistance in hospitals, they prefer to be regarded as insane rather than to be deprived of aid. They often pretend to suffer from post-paroxysmal mental disorders which do not exist in order to facilitate their admission. After admission they are retained as epileptics and not as lunatics.

HANDBOOK TO

DR. KOCH'S TREATMENT

IN

TUBERCULAR DISEASE.

BY

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HANDBOOK TO

DR. KOCH'S TREATMENT IN TUBERCULAR DISEASE.

PART I.

INTRODUCTION.

MANY attempts have been made from time to time to combat that most wide-spreading of all diseases, namely, Tuberculosis, in its different forms of lupus, chronic and acute affections of the bones and joints, etc., and especially of that most obstinate and deadly foe to humanity, consumption, or tubercular disease of the lungs. And each fresh attempt has, after being heralded with a great flourish of trumpets, been found worthless, or all but so. It is therefore only natural that the announcement of Professor Koch's marvellous discovery in Berlin should have been received with a considerable amount of incredulity. We are publishing this little book in the hope that it may avail as the first on the subject in this country, in clearing up any doubts in the lay or even professional mind as to the efficacy of the treatment; and also that it may serve as a practical handbook for physicians in the actual administration of the remedy, when it chances, as we have reason to believe it may, to come into the hands of every careful practitioner. We say this the more readily as the whole system of injection for tuberculosis, as it is being practised at Berlin, is so simple in technique, that with attention to certain details, hereafter to be given, as soon as sufficient lymph comes to hand, the carrying out of the same will be possible to every naturally capable medical man. It is with the desire of mak-

ing the system in its details apparent to the conception of such men that this book is published, and believe its publication to be neither premature nor unnecessary, as the literature on this subject is at present merely scattered over various journals, and one pamphlet; even these having aroused both lay and professional curiosity to the highest pitch; and bacteriology has for various reasons been so little studied in England that it is only now that most of our medical men are, since this marvellous result of a laborious research, roused up by uncontrollable curiosity to the fact that they have neglected, and even sneered at, a science which should long since have been at the basis of at least all their theoretical considerations of infectious and hereditary disease. The observations are the result of personal investigation on the spot, chiefly at the Charité Hospital, Berlin, where, owing to the kindness of Drs. Fräntzel and Runkwitz, the various items of information were collected. We will now pass on to a short résumé of procedure adopted by Koch and other systematic workers in the investigation of bacillus tuberculosis, as a prelude to describing the treatment itself.

POINT HOUSE, PUTNEY.

9 EARL'S COURT SQUARE,
South Kensington, Nov. 20th, 1890.

THE BACILLUS TUBERCULOSIS.

The specific organism which has been discovered by Koch, and so ably and conclusively proved by him to be the acutal cause of tuberculosis, presents itself in small, thin, rod-like forms, and multiplies by means of spores; it therefore belongs to that division of bacteria called bacillus (Latin: baculus, a little rod). These rods are sometimes bent and sometimes straight, and vary considerably in length and thickness. This organism is one of those which is so minute that it is practically impossible to see it unless it is brought into contrast with surroundings of débris, tissue, or cell nuclei, by means of staining it with anilin dyes, and leaving the background unstained, or *vice versâ*. This property (so invaluable to the bacteriologist) of the protoplasmic substance of bacteria being capable of absorbing such brilliant coloring matter as anilin dyes was what first led Koch to his discovery of the tubercle bacillus. We now are possessed of a very certain way of dis-

tinguishing the tubercle bacilli in sputum, etc., from other organisms by the fact that, after staining the whole débris and bacilli together with fuchsin (magenta) and on immersing in dilute nitric acid, the color is abstracted from the surrounding substances and all other bacteria, leaving the tubercle bacilli standing out as red rods on a colorless or very pale ground.

The technique to be observed is, roughly, the following: Prepare satd. alcoholic solution of rosanilin hydrochloride (fuchsin) and then shake up a few drops of anilin (anilin oil coml.) with distilled water violently in a test tube, filter the emulsion, and pour the filtrate into a watch glass; add two drops of the solution of fuchsin to the anilin water, and this mixture is the stain to be used. Take the specimen of sputum to be observed, and pick out with a needle one of the little caseous yellow masses, smear this on a thin cover glass, dab another cover glass on the top, press, and draw them apart, so as to get two cover glasses with a thin film of cheesy matter on each. Let them dry. Next take each and pass it moderately quickly three times through a Bunsen burner or spirit-lamp flame. Warm the stain in the watch glass, and place the cover glasses face down successively for about fifteen minutes in stain after warming it till steam appears. Hold cover glass in nitric acid (dil.) till quite colorless, and wash thoroughly with distilled water from wash bottle; the background of débris, and other organisms may now be stained blue for contrast by immersing cover glass for five minutes in an alcoholic solution of methylen blue diluted with water. Re-washing. Passing through alcohol, and leaving to dry with edge on blotting paper. This cover-glass preparation may be mounted in Canada balsam. There are many rapid stains, such as that of Dr. Henneage Gibbe, but they must be sought for in the treatises of their respective authors.

The method of staining adopted at the Charité is as follows:—

Prepare C.P.'s as before, after passing three times through Bunsen flame to coagulate albumin. Proceed thus:—

Make three solutions, A, B, and C—

A. Fuchsin 1, alcohol 10, phenol 5, water 100.

B. Nitric acid 1, distilled water 2.

C. Methylen blue 1, water to saturation.

One drachm sol. A in watch glass, heat till steam rises for a few seconds, and float c.g., remove with forceps and wash in sol. B till colorless, wash in alcohol, then into sol. C, wash in water, pass through alcohol, leave to dry with edge on blotting paper, and examine.

In making a "pure" cultivation of the tubercle bacillus, much greater attention to details, much greater care has to be observed, and a considerably longer time has to be expended than in the case of most other organisms. The organism can only be cultivated to any extent on blood serum. The serum is introduced into sterilized, plugged tubes, sterilized by a very long method extending over a week, solidified (inspissated), and then inoculated with a platinum needle (öse) previously heated to redness and allowed to cool. The tubercular substance used for the inoculation must be taken from the very centre of a tubercular nodule, after first cutting off all the outside quickly with clean hot scalpels. About ten or twelve tubes should be inoculated in each case, and left in the incubator at temperature of 35°–37.5° C. (or about 97°–99° F.). After about ten days' to two weeks' incubation, one sees signs of multiplication of the bacilli, and after a time the small separate colonies which have at first appeared, unite, and finally the whole inoculated portion of the previously shining flat surface of serum appears covered with yellowish-gray, hard, dull scales, consisting of millions of bacilli packed close together. Other so-called "generations" of bacilli may be cultivated from these, by inoculating fresh tubes of blood serum with small particles of the old cultures, and this may be done so often that we may rest assured that nothing of extraneous substances remains from the original tubercular material inoculated into the first tube.

A small fragment of any of these cultures introduced into a little pocket in the subcutaneous tissue of a rabbit, or Guinea pig, renders the part, after a short time, tubercular. An abscess appears, the surrounding tissues break down and caseate, and finally, after from four to seven weeks, general tubercular symptoms set in, and the animal dies. The tubercle bacillus may be found distributed throughout the organs at the autopsy, the lungs being covered with small and large grayish tubercles, and sections may be cut, and further inoculations made.

In the above very curtailed description of Koch's laborious years of research are contained his postulates, or conditions of proof to be fulfilled before we can certainly say that any particular organism is the actual *causa causans* of any specific disease.

These postulates he laid down as follows:—

(1.) The organism must be found in any animal dead or suffering from the disease in question.

(2.) From this animal the organism must be cultivated through successive generations on nutrient media outside the animal body.

(3.) The cultivated organism must, after going through several culture series or "generations," again produce the disease in question, with its characteristic symptoms, on inoculating it into healthy animals.

(4.) In these experimental animals, either before or after death, the organism must again be found, and fresh cultures established.

Unless the above postulates have been fairly carried through, it is impossible to state definitely and authoritatively, that any given parasite is the cause of a disease. But if they are carried out accurately, they are amply sufficient proof of a very scientific kind, and they have been carried out in numberless experiments all over the world since Koch's first work on the subject, by various conscientious workers.

PART II.

THE "LYMPH" OR ACTUAL FLUID INJECTED.

THE lymph as it issues from Professor Koch's laboratory at the Hygienic Institute in Berlin, is a clear, tolerably mobile, straw-colored liquid, almost inodorous, and with a slightly saline taste, and is not, as many conjecture it to be, an "attenuated" culture of bacillus tuberculosis; in fact, the principle of Dr. Koch's method of cure is not that which was first used by Pasteur in the case of anthrax, and does not depend upon the principle of "mitigation of the virus," being perhaps more allied to what might be called nachimpfung, or overtaking treatment, because the injection produces a subsequent benign pathogenic condition. But the fluid itself not containing the organisms, it is not a case of acclimatization of the system, as is the theory of the inoculation of hydrophobia virus in an attenuated or mitigated state, but if we may be allowed to guess, we would suggest that this treatment depends for its principle on the fact that the bacillus, like others, is killed by an excess of its own poisonous excreta, which bacterial excreta are called "ptomaïnes."

The active principle contained in the lymph is so excessively powerful in its action that the actual maximum strength of lymph as at first obtained would be far too strong to use; the strongest solution which is actually used in the injections, even in the most extreme cases, is this "original" lymph, diluted ten times (ten per cent, diluted with distilled water to which has been added one per cent phenol). And the maximum quantity injected in one place is one cubic centimetre. The injections are made, not with the ordinary hypodermic syringe of Pravaz, but with a modification of this invented by Koch, and used by him all through his bacteriological work. The essential difference between the two is, that for the piston in the ordinary syringe, which would be very difficult to effectually sterilize, is substituted a ball of india-rubber, to which

the glass portion is connected loosely, but air-tight by being ground in, while at the other end of the ball is an aperture, to be covered while in use by the finger, so that air may be admitted as needed. At the point, the needle is fixed, and the instrument holds to the tenth graduation at zero, exactly 1 c.c., each division being one c.mm. To sterilize the syringe, it suffices to rinse the glass part first with mercuric chloride solution 1 in 2,000, and then thoroughly with absolute alcohol.

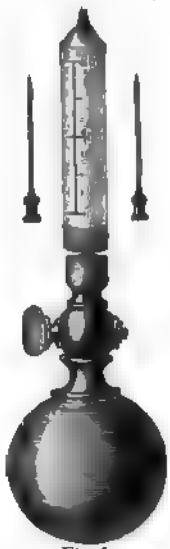

FIG. 1.

When the lymph is once diluted, its keeping properties are considerably diminished. Not only is it more subjected to chemical change —presumably of the ptomaïne in solution undergoing decomposition, or rearrangement of the atoms in the molecule—but also it is nearly sure during previous operations to have derived bacterial impurities from the atmosphere or surrounding objects, so that before use each time the solution should be heated up to kill any spores of bacteria which may have sprouted in the intervening time.

But after a certain number of times of heating up, it is observed that the effect of the lymph goes off considerably, also owing probably to a chemical decomposition or change which goes on, promoted by the repeatedly raised temperature, so that freshly diluted lymph must be prepared every few days.

Since Dr. Koch's fluid, when taken by the mouth, is absolutely inert, and although the effect of the fluid when inhaled is very powerful, still in this method the dosage is so difficult to control that for purposes of general convenience and scientific accuracy it is in every way better to administer the fluid by means of the hypodermic syringe.

PART III.

THE INJECTION.

It would appear at first sight a very simple matter to inject subcutaneously with a hypodermic syringe a fluid, and thus succeed in curing a case of lupus; but, and this it is most important to observe, the fluid is of such an intensely active nature, so prone to undergo decomposition through careless manipulation, that almost certainly, unless careful antiseptic precautions are observed, abscesses of excessively severe nature, with or without general pyæmia, or even fatal septicæmia, would result. The antiseptic precautions which it is necessary to take are the following: First, the syringe must be carefully sterilized in the way already described; second, the place where the injection is to be made must be washed with absolute alcohol (the hands of operator after well washing should also be rinsed with absolute alcohol); and third, the cotton-wool plug in the tube of diluted lymph ought only to be removed for so long a time as will allow a certain quantity to be removed by the syringe, and then quickly replaced. The tube of needle must be cleansed before and after every operation with the silver wire and absolute alcohol.

The injection must be made on the opposite side to that on which the patient habitually lies, below the shoulder blade, in the region of the latissimus dorsi; otherwise the subsequent local tenderness interferes considerably with sleep. The injections are preferably made early in the morning, 9 A.M. is the time adopted in Berlin, and would be a good hour at all times. The weakest injections must be commenced with a solution of such strength that on injecting one cubic centimetre of liquid *in toto*, the patient shall receive 0.001 of strong original lymph. The temperature must then be observed every four hours, in order that the time when the "reaction" (the rise of temperature consequent on injection will subsequently always be spoken of as the "injection reaction," or merely "reaction." It

is interesting to note, as will be seen hereafter, that this sets in, as a rule, six hours after injection) sets in may be observed, and that any other results of this reaction may also not escape notice. When no further injection reaction sets in, the strength of the solution must be increased, for the reason that if a strong solution is at first made use of, the reaction is great, but a tolerance is the sooner established, and the following treatment produces little or no benefit. This does not, however, apply to lupus cases, where a lymph as strong as 0.01 may be begun with at the first trial.

In injecting, the needle must be pushed right home, and the fluid slowly forced in and allowed fully two minutes for its total expulsion and entrance flow into the tissue.

PART IV.

THE EFFECTS OF THE INJECTION.

THE effect of the injection upon any case where used for first time is to produce in the course of about three hours, according to the nature of the case, a decided rigor followed by a fairly sudden rise in the temperature, which, as example in case W., rises from 36.8° (98.2°) at 3 P.M. to 101.8° (38.8°) at 6 P.M.; at 9 P.M. to 104°—sinking again by morning to 99.2°. If the case present a local lesion of tuberculous nature, this lesion swells and becomes tender, the skin over it becomes somewhat inflamed. The patient feels drowsy, disinclined to stir, nauseated, and loses his appetite for the time being. In cases of advanced phthisis, the temperature has risen to 41° = 105.8°, fatal collapse has come, and the temperature sinking to 35°, the patient has died. This has only taken place in cases of very advanced phthisis with cavities. The reaction is much greater in cases where tubercle exists than in non-tuberculous cases; so much so is this the case that the injection of an attenuated solution may be looked upon as a fairly trustworthy guide in the diagnosis of commencing cases of phthisis, where physical signs are incapable of detection. With strong doses, a reaction may be obtained in the healthy untuberculous subject. (Even this is still doubtful, as our evidence on this point was Professor Koch's injection of himself; but lately it has been stated that he has unhappily become the subject of tubercle.) The reaction subsides in less than twenty-four hours, and the patient becomes, to a great extent, tolerant of future injections of the same strength.

The temperature often becomes subnormal; and it may be stated that the higher the temperature of the reaction the lower will it subsequently fall.

An increase in the dose by no means always produces an increased temperature, but it is advisable to begin with the lowest possible dose, otherwise the limit of dosage is soon

reached, and the patient becomes tolerant. It does not, however, follow that, because the patient becomes tolerant and no reaction follows, the injection ceases to produce benefit, although the physicians treating the cases at present are rather inclined to adopt this view.

The rapidity of the pulse rises considerably during the reaction, and often reaches a rate of 130 to 140 to the minute, Dr. Köhler, at the meeting of the Medicinische Gesellschaft, stating it had gone up as high as 160 without failure of the heart's action. Where patients have previously suffered from asthma, an attack often sets in during the reaction. Other patients who had not previously suffered from asthma were troubled with some dyspnœa during the reaction.

The injection is well borne by children at Professor von Bergmann's clinic; one child was injected who could not have been more than five years old.

At the meeting of the Medical Society of the 20th of November were shown two cases where a well-marked exanthematous rash appeared over the front of the chest, the legs, and arms, which rash lasted about two days.

In cases of phthisis, when an injection is made, preferably at about 8 A.M.—for it appears that the earlier in the morning the injection is made the sooner the reaction will set in—a working in the system begins to take place within three hours, carrying a rise of temperature, termed the reaction, accompanied by an increase in frequency of the cough, and more distress with the same, a feeling of restlessness and shortness of breath; at first the patient feels undoubtedly worse, and there is occasionally some slight collapse, which, if necessary, must be treated with the free administration of stimulants; in short, the patient must be watched. The intensity of the reaction is in ratio to the stage of the disease; in the advanced cases the reaction is so great as to occasionally produce dangerous symptoms, and these cases must be treated with very dilute solutions to insure perfect safety.

When there has been a previous elevation of temperature, what is called a "disease fever" (Krankeitsfieber), the reaction rise is marked, and there then follows a fall which includes both the reaction temperature and the disease fever.

The sputum becomes much more fluid, loses its yellow color, and diminishes in amount, being at the same time much

easier to expectorate. The cough becomes softer and moister. The patient begins to improve in weight. The bacilli undergo an early diminution in numbers, and also an alteration of form when seen under the microscope, many slides (which I was shown by the kindness of Dr. Runckwitz at the Laboratory of the Charité) exhibiting these changes in a marked degree. The special change being a lessening of the size, a breaking up into débris, and a bending into a half-moon shape, some

FIG. 2. Tubercular Sputum. Before the injections.

FIG. 3.—After injections.

NOTE.—The degenerated bacilli are more difficult to stain than healthy bacilli.

exhibiting a swelling at either end; this is not only noticed in one or two of the specimens on the slide, but the whole slide is in this condition, a healthy, well-developed bacillus being difficult to find; in other words, the bacilli evidently undergo a species of degeneration. Sufficient are probably left, however, to form a fresh nidus of infection if the treatment were discontinued at this stage, and it must be assumed that it will in all cases be necessary to continue the treatment until the sputum is entirely free from bacilli. The rate of disappearance

of the bacilli is approximately about as follows, according to the Gaffsky table (the Gaffsky table is for the purpose of facilitating the expression of the number of bacilli in a specimen of sputum): 1st week, innumerable; 2d week, nine, end of second week, eight; 3d week, seven, six, five; 4th week, practically none. This from a case of well-marked phthisis with intense cough, profuse expectoration, crepitation and dulness over the lungs.

The influence upon the percussion note is well marked in the cases quoted at the end of the book. In some cases the dulness has been found much diminished in area. The crepitations have disappeared. This was carefully observed in Cases I. and II.; in Case II. there was dulness down to second rib. When last examined on November 21st, the dulness had all but disappeared, and no crepitations could be heard, although Dr. Runkwitz noted that a few were to be detected.

Upon the weight the influence is most marked in Case II. This, on admission, was only 108¾ pounds, even allowing for possible error of the weighing chair; still on the 29th September 116, on the 13th November 124 pounds, on the 22d November 125 pounds. (This case I weighed myself, so have no doubt as to the *bona fides* of the increase, although the amount seems large.—E. F. G.)

The night sweats entirely disappear in most cases after the first fortnight, and this may account for the increase in weight.

The fluid is a mobile liquid of deep yellow color of somewhat high refraction, smelling slightly of carbolic acid, tasting slightly saline, and is derived from cultures of the tubercle bacilli. The strength may be assumed to be saturated, which will be taken as represented by 1.0. For injection this fluid has been used in almost every strength from 0.5 upon Professor Koch himself down to 0.001, which is the weakest strength used. The different strengths used in different cases will be stated as the cases are described.

The original fluid, if preserved antiseptically, does not undergo any change on keeping. Its solutions, however, do not keep even under antiseptic precaution for more than two or three weeks. The greater the dilution, the more rapid is the liability to change.

There appears to be a certain amount of anæmia produced

by the reactions; a very liberal diet, including about four or five glasses of wine per diem, being advised. But the physicians of the Charité set great value upon the production, when possible, of reaction.

At the meeting of medical society, Nov. 21st, were shown certain cases of surgical wounds which had been injected. In these cases there being no tuberculosis, no reaction ensued, nor did the scars or wounds show any alteration. One case shown of a man with a very bad burn of the right arm with a granulating surface, in the centre. An injection of 0.5 solution was made, giving rise to considerable reaction, but the wound in the arm showed no alteration.

In the case of a lad shown, a most interesting fact was noticed by Dr. Köhler. The lad had a skin eruption which was presumed to be tuberculous; an injection was made, good reaction ensued, a scrofulous gland beneath the neck showed local reaction, but the skin eruption showed no change. Therefore the skin eruption was presumed to be syphilitic. In another case, one of lupus, after injection, local reaction was apparent at the seat of the lupus, but no local reaction was visible at an enlarged gland in the groin.

These cases show the value of the injection as a means of differential surgical diagnosis, for though the injection may in non-tuberculous individuals produce general symptoms, yet it behaves with indifference to non-tuberculous wounds and enlargements. In the tuberculous enlargements the local reaction is never absent (Köhler).

Next, with regard to patients suffering from tuberculous affections.

First, with regard to its effects upon lupus. In cases injected with a one-per-cent solution, after about three hours, the general reaction would become manifest, first a rigor, then the usual rise of temperature accompanying the reaction. Certain general symptoms are also apparent: loss of appetite, furred tongue, headache, pains in the back and stomach, diarrhœa.

Concerning Local Reaction.

In lupus the first effect is to produce within three hours a feeling of burning tightness and heat over the face and nose of the affected patient, at the same time as the commence-

ment of the rigor the nose becomes noticeably reddened. In six hours the swelling and redness reach their highest point. The redness and swelling are not confined to the affected part, but implicate the skin for some distance around; at about the same time an ample exudation of a yellow fluid similar to that found upon an eczematous surface, which dries into crusts upon the surface. The exudation continues for about forty-eight hours. After two days the redness and swelling begin to subside, and after five days are only apparent upon the affected part, and even this becomes considerably paler during the following three weeks; five days after the injection the scales begin to dry up and fall off. On the ninth day they allowed themselves to be taken freely off their basis. The affected part now appears quite shrunken, red, and shiny, just as those parts of a lupous patch appear which have been treated with a Volkmann's spoon. After a certain number of days the swelling of the nose subsides, and the organ regains its natural shape and outline; however, a number of small tuberculous spots remain, most of them about the size of a pin-head, forming a soft red prominence whose centre often carries a small scale. These spots, in the case under observation, increased considerably in size before the day of the second injection. The second injection was made twenty-seven days after the first, and repeated three times at intervals of two days. After each injection redness, swelling, and exudation took place, although not to the same intensity as the first time. At the time when the patient was shown, the swelling and scaling had still not completely finished. In one case exhibited, some tubercles imbedded deeply in the skin had so far resisted the treatment, and Dr. Köhler gave as his opinion that this resistance was due to the thickness of the elastic tissue of this part of the skin preventing the outlet of the exudation to the surface, and thought it highly probable that absorption of the masses would take place. The only example shown in which an absolute complete cure had been established was one, a woman, in whose case Volkmann's spoon had been freely applied before injection. This rather spoilt the scientific value of the evidence it supplied. In a case of enlarged tuberculous glands, after injection, swelling and pain took place at the seat of enlargement. At the same time all the enlarged glands were not equally affected; some of the

glands became very enlarged and painful, others not nearly so much, if at all, affected. The value of this observation is apparent, for it shows that some glands were more infiltrated than others.

In Disease of the Ankle and Knee Joint.—The joint after injection becomes swollen, and the skin over it tense and inflamed. The swelling and inflammation after a few days begin to subside, and the size of the joint obviously to diminish, the skin being somewhat wrinkled about the foot. In the knee cases the diminution in size was not so apparent, but there was great freedom of movement in what had previously been a stiff joint.

In one case where injection was practised for enlarged glands in the neck, three days after the injection an acute inflammation of the cornea set in with strong pericorneal injection. In this case it is probable that some tubercular affection of the eye may have been present.

The question as to how the injection would affect a tubercular meningitis is not altogether devoid of interest.

In Cases of Enlarged Glands.—A swelling first takes place, with tenderness, heat, and redness, followed by perceptible diminution in the size of the gland.

In Cases of Joint Disease shown by Professor von Bergmann: Hip Disease.—There is at first great pain and tenderness about the joint, the leg becomes flexed and fixed, where sinuses are present leading into the joint, there is speedily a diminution in the amount of the discharge which also undergoes an alteration in consistency, becoming thinner and more fluid. Von Bergmann has shown four cases of hip disease in which injection was made; there are, however, other cases at the Charité Hospital. In one case Von Bergmann took a patient in for the purpose of correcting the flexion of the knee, and using passive motion. After the injection, however, the swelling of the joint gave an undoubted diagnosis of active tubercular mischief, and caused an entire retrocession of the system of treatment to be adopted.

Where fixation of the hip-joint has existed with flexion, after fourteen days a general improvement has taken place, with disappearance of pain and possibility of freedom of movement. Where abscess of the joint existed, cases have been treated with opening of the joint, scraping out of the abscess

without any subsequent formation of pus. The whole of the cases of hip-joint disease which have been under treatment have, without exeption, improved after injection, although many were cases where absolute destruction of the joint had already taken place, and no hope of complete cure was possible. Dr. Bergmann in particular has dealt especially with the cases of hip-joint disease, and no man can deny the extent of his success.

Tubercular Laryngitis.—One case of tubercular laryngitis under treatment since November 10th. Three other cases have not been long enough under treatment to afford any useful experience.

In all cases a considerable swelling of the larynx has taken place shortly after injection.

A man suffering from supposed carcinoma of larynx was injected; in this case the larynx showed no alteration after injection, again the value of injection as a means of differential diagnosis was apparent. The possibility of suffocation due to swelling of the larynx must be borne in mind; at present no case has occurred.

Phthisis.—In regard to the value of the treatment in incipient lung disease, we may at first consider its value for differential diagnosis as a means of deciding whether a certain case is one of commencing phthisis or only a bronchial catarrh. There is no doubt we have a most important and invaluable specific, one which on closer acquaintance appears to be almost infallible in its indications. As a means of treatment, combined with therapeutic agents, we have undoubtedly an absolute means of cure. In acute phthisis its influence appears to be equally valuable, but in these cases the tendency to toleration of the specific, and the liability to recurrence of the disease, will give rise to greater difficulty. In the very advanced cases with large cavities its use is most dangerous, and cases have already been observed where death has ensued from collapse in less than forty-eight hours of injection of the solution. It is true these cases would have succumbed to disease in a comparatively short time, and many patients in this condition would willingly run the risk of the treatment, for with greater attenuation, smaller doses, and wider precautions against collapse, a hope might still be entertained of, if not a cure, at any rate, an arrest of symptoms for a time, perhaps.

It is curious that the injection should in certain cases bring on asthma; possibly this fact may lead us to a better understanding of the asthmatical condition, as these two diseases are seldom met with in conjunction. In cases of chronic bronchial catarrh, the injection will probably be found of no use whatever, as this is a condition in which tubercle bacillus has no share, and it is a condition which is more frequently mistaken for consumption than is perhaps generally believed. The only benefit the injection will give to these cases will be to apprise them of their non-tuberculous state.

For although a reaction does set in in healthy subjects, it is only when a very large dose is used, such as Professor Koch used upon himself, but the 0.01 injection appears to leave no influence on the healthy person.

PART V.

EXAMPLES.

Actual Cases.—All the cases to be subsequently quoted were personally seen by Mr. Grün at Berlin. Some were seen presented at the meeting of the Berliner Medicinische Gesellschaft at the Charité Hospital, November 21st; others at the clinic of Professor von Bergmann, and in the wards of the Augusta Hospital; others, by the kindness of Drs. Fräntzel and Runkwitz, in the wards of the Charité Hospital. The notes of some of these cases have already been published ("Medicinische Wochenschrift," 20th November, 1890), but I think the cases quoted here will be found to be both fuller in history and detail than the same as quoted in the "Wochenschrift." Also by grouping all these cases, derived from varied sources, a better generalization is to be obtained, and more comprehensive view of the whole situation.

Cases of Lupus. 18 *Cases.*

1. Fräulein K., 34 years old, under care of Dr. Levy, p. 1,057.
2. Fel. D., 61, Levy.
3. Theip.
4. Thom.
5. Kock, 58 years.
6. Gunther, 14 years.
7. Gilver, 43 years.
8. Neumann, 22 years.
9. Neal, 22 years.
10. Schmidt, 18 years.
11. Noak, 13 years.
12. Coln, 17 years.
13. Gottschlich, 24 years.
14. Friese, 31 years.
15. Klingbele, 24 years.
16. Wachter, 45 years.
17. Bellermann, 32 years.
18. Weigt, 26 years.

Cases of Tubercular Laryngitis.

Kegel.
Nelske.
Gendrich.
Aussow.

Cases of Pulmonary Phthisis.

1. C. Tischler.
2. S. Rangirer. — Advance cases—
3. B. Kettner. — Fräntzel.
4. K. Gluser.

1. B.
2. W.
3. W.
4. W. — Cases of commencing phthisis—
5. H. — Drs. Fräntzel and Runkwitz.
6. D.
7. B.
8. E.

Cases of Pulmonary Phthisis.—There have been 12 cases of pulmonary phthisis under the observation of Drs. Fräntzel and Runkwitz at the Charité Hospital, Berlin. Through the kindness of Professors Fräntzel and Runkwitz, we have been able to examine these patients and collect their histories.

There is one of the name of Weigt, who has been under treatment since the 13th of September, and he was the first case treated; his temperatures have been taken four times daily from the 13th September to the present date, and these temperatures will serve to illustrate very clearly the course and effects of the treatment.

Cases of Tubercular Joint and Bone Disease.

Anna S., under Dr. Levy, inflammation of humerus.
Boywardt, rheumatic ankle joints, with enlarged cervical glands.
Spichalski, tubercular disease of ankle joint.
Kramer, residuum of knee.
Gertrud Freyer, tubercular hip disease.
Martha Ropler, tubercular hip disease.
Anna Wollf, tubercular hip disease.
Martha Schultz, tubercular gonitis.
Rudolf Freitag, suppurating hip disease.
Wilhelm Semerau, hip disease.
Max Reisinger, left hip disease.
Herman Schlousky, wrist-joint disease.
M. Spiegelberg, metatarsal disease.
Charlotte Voutaal, spina ventosa.

M. Frounn, tubercular ankle-joint disease.
Willy Ziegelsdorf, coxitis.
Tylitzki, coxitis.
Oskar Schleusmer, coxitis.
Rudolf Weis, gonitis.
Karl Posse, coxitis.

CASE I.—August Weigt. Charité Hospital, No. 10 Warde, under care of Professor Dr. Oskar Fräntzel and Surgeon Dr. Runkwitz.

Patient, age 26. Shoemaker. September 2d, 1890. Family history good; no consumption in family. Admitted into the Charité suffering from severe cough; night sweats. Thick yellow expectoration, ½ pint in 24 hours. Sputum full of bacillus tuberculosis. On right side dulness down to second rib. Crepitations. Left lung free. Weight on admission, 108¾ lbs.

September 2d—

Condition.	Temperature.	Treatment.	Remarks.
Weight, 108 lbs. Severe cough day and night. Night sweats. Expectoration 4 ozs., thick yellow. Innumerable bacilli in sputum.	Morning, temperature on admission, 100.4°. Evening temperature, 101°.	Creosote inhalations. Morphia sulph., gr. ¼, three times daily.	

Date.	Time.	C°.	F°.	Injections.
September 13....	11 p.m.	36.8	98.2	Solution injected 0.001 at 11 a.m.
	3 p.m.	36.8	98.2	Bacilli innumerable.
	6 p.m.	38.8	101.8	
	9 p.m.	40.0	104.0	
September 14....	7 a.m.	37.3	99.2	
	10 a.m.	37.5	99.5	
	1 p.m.	37.0	98.6	T. B. 8.
	3 p.m.	37.3	99.2	
	6 p.m.	36.8	98.2	
	9 p.m.	37.8	100.0	
September 15....	9 a.m.	36.8	98.2	Injected fresh solution, 0.002.
	10½ a.m.	36.6	97.8	
	2 p.m.	39.0	102.2	T. B. 8.
	5 p.m.	37.1	98.8	
	8 p.m.	36.6	97.8	

Date.	Time.	C°.	F°.	Injections.
September 16....	7 a.m.	36.4	97.5	Fresh injection.
	11 a.m.	37.0	98.6	
	2 p.m.	36.2	97.2	T. B. 8.
	8 p.m.	37.2	99.0	
September 17....	7 a.m.	36.0	96.8	Fresh injection. T. B. 8.
	No further reaction.			
September 18 ...	7 a.m.	37.1	98.8	Fresh injection.
	10 a.m.	36.6	97.8	T. B. 8.
	1 p.m.	37.0	98.6	
	4 p.m.	36.4	97.5	
September 19....	7 a.m.	..	..	
	11 a.m.	..	..	
	2 p.m.	..	..	
	8 p.m.	..	..	

Sept. 20th. Injection of 0.002. No reaction. Sputum has become clear.

Sept. 21st. Injection of 0.002. No reaction. Clear.

Sept. 22d. " " " "

and so on till:

Date.	Time.	C°.	F°.	Injections.
September 25...	6 a.m.	36.5	97.7	Injection of solution, 0.01. Two injections.
	9 a.m.	36.3	97.4	
	2 p.m.	37.4	99.3	T. B. 7.
	3 p.m.	37.5	99.5	
	6 p.m.	37.3	99.2	
	9 p.m.	37.0	98.6	
September 26...	6 a.m.	36.7	98.0	Two injections, 0.01.
	9 a.m.	36.6	97.8	
	2 p.m.	37.2	99.0	T. B. 8.
	3 p.m.	37.7	99.8	
	6 p.m.	37.0	98.6	
	9 p.m.	37.0	98.6	
September 27....	6 a.m.	36.8	98.2	Two injections.
	9 a.m.	36.8	98.2	
	12 noon.	37.3	99.2	
	3 p.m.	37.4	99.3	
	6 p.m.	37.2	99.0	
	9 p.m.	37.3	99.2	
September 28....	6 a.m.	36.5	97.7	No injection.
	9 a.m.	36.4	97.5	
	2 p.m.	37.1	98.8	
	3 p.m.	37.4	99.3	
	6 p.m.	37.4	99.3	
	9 p.m.	37.2	99.0	

Date.	Time.	C°.	F°	Injections.
September 29....	6 a.m.	37.7	99.8	Two injections.
	9 a.m.	37.2	99.0	
	12 noon.	37.8	99.2	Weight, 116½.
	3 p.m.	37.5	99.5	
	6 p.m.	37 4	99.3	
	9 p.m.	37.0	98.6	
September 30 ...	6 a.m.	36.6	97.8	No injection.
	9 a.m.	36 8	98.2	
	12 noon.	37.5	99.5	
	3 p.m.	37.8	100.0	
	6 p.m.	38 4	101.2	
	9 p.m.	38.1	100.6	
October 1.....	6 a.m.	37.7	98.0	Two injections, 0.01.
	9 a.m.	36.8	98.2	
	12 noon.	37.4	99.3	
	3 p.m.	37.2	99.0	
	6 p.m.	37.3	99.2	
	9 p.m.	37.0	98.6	
October 2..	6 a.m.	36.3	97.4	No injection.
	9 a.m.	36.4	97.5	Diarrhœa.
	12 noon.	36.6	97.8	
	3 p.m.	37.0	98.6	
	6 p.m.	36.5	97.7	
	8 p.m.	37.0	98.6	
October 3.....	6 a.m.	36.5	97.7	Two injections.
	9 a.m.	37.0	98.6	
	2 p.m.	37.2	99.0	
	3 p.m.	37.5	99.5	
	6 p.m.	37.8	100.0	
	9 p.m.	37.6	99.7	
October 4.... ...	6 a.m.	36.8	98.2	No injection.
	9 a.m.	36.6	97.8	
	2 p.m.	37.4	99.3	
	3 p.m.	37.7	99.8	
	6 p.m.	37.9	100.2	
	9 p.m.	38.2	100.8	
October 5.....	6 a.m.	37.2	99.0	Two, 0.01.
	9 a.m.	36.9	98.4	
	12 noon.	37.3	99.2	
	3 p.m.	37.4	99.3	
	6 p.m.	37.6	99.7	
	9 p.m.	37.8	100.0	
October 6.....	6 a.m.	36.5	97.7	None.
	12 noon.	37.0	98.6	
	3 p.m.	37.3	99.2	
	9 p.m.	37.7	99.8	
October 7.....	6 a.m.	36 8	98 2	Two, 0.01.
	9 a.m.	36 6	98.4	
	12 noon.	37.2	99.0	Weight, 116.
	3 p.m.	37.4	99.3	
	6 p.m.	37.9	100.2	
	9 p.m.	37.9	100.2	

Date.	Time.	C°.	F°	Injections.
October 8	6 a.m.	36.5	97 7	No injection.
	9 a.m.	36.7	98.0	
	3 p.m.	36.9	98.4	
	9 p.m.	37.5	99.5	
October 9.....	6 a.m.	36.4	97.5	Two, 0.01.
	2 p.m.	36.9	98.4	
	3 p.m.	37.2	99.0	
	6 p.m.	37.4	99.3	
	9 p.m.	37.6	99.7	
October 10.....	6 a.m.	36.2	97.2	None.
	9 a.m.	36.4	97.5	
	12 noon.	36.7	98.0	
	3 p.m.	36.9	98.4	
	6 p.m.	37.2	99.0	
	9 p.m.	37.7	99.8	
October 11.....	9 a.m.	36.3	97 4	Two, 0.01.
	12 noon.	36 5	97.7	
	6 a.m.	36.7	98.0	
	3 p.m.	36 9	98 4	
	6 p.m.	36.9	98.4	
	9 p.m.	36.2	97.2	
October 12.....	6 a.m.	36.2	97.2	None.
	9 a.m.	36.4	97.5	
	12 noon.	36 8	98.2	
	3 p.m.	37.3	99.2	
	6 p.m.	37 8	100.0	
	9 p.m.	37.2	99 0	
October 13.....	6 a.m.	37.0	98.6	Two, 0.01.
	9 a.m.	37.2	99 0	
	12 noon.	37.4	99 3	Weight, 120¼ lbs.
	3 p.m.	37 5	99.5	
	6 p.m.	37 7	99 8	
	9 p.m.	37.5	99.5	
October 14. ...	6 a.m.	37.5	99.5	None.
	9 a.m.	37 8	100 0	
	12 noon.	38.4	101.2	
	3 p.m.	38.7	101.6	
	6 p.m.	38.5	101.3	
	9 p.m.	38 2	100.8	
October 15.... ..	6 a.m.	37.5	99.5	Two, 0.1.
	9 a.m.	37 2	99 0	
	12 noon.	37.9	100 2	
	3 p.m.	38.2	100 8	
	6 p.m.	38.1	100.6	
	9 p.m.	38.0	100.4	
October 16	6 a.m.	37.0	98.6	No injection.
	9 a.m.	37.4	99.3	
	12 noon.	38.4	101.2	
	3 p.m.	39 0	102.2	
	6 p.m.	39 0	102.2	
	9 p.m.	38.0	100.4	

Date.	Time.	C°	F°.	Injections.
October 17.....	9 a.m.	35.7	96.3	One, 0.1.
	12 noon.	37.0	98.6	
	3 p.m.	37.8	100.0	
	6 p.m.	37.6	99.7	
	9 p.m.	37.9	100.2	
October 18.....	7 a.m.	36.8	98.2	No injection.
	10 a.m.	36.8	98.2	Weight, 116 lbs.
	1 p.m	38.1	100.6	
	4 p.m.	38.0	100.4	
October 19.....	7 a.m.	36.9	98.4	One injection.
	10 a.m.	37.0	98 6	
	1 p.m.	37.5	99 5	
	4 p.m.	38.0	100.4	
	7 p.m.	38.5	101.3	
October 20.....	7 a.m.	36.7	98.4	No injection.
	10 a.m.	37.0	98 6	
	1 p.m.	37.9	100 2	
	4 p.m.	37.8	100.0	
	7 p.m.	38.0	100.4	
October 21.....	7 a.m.	36.7	98.0	One injection.
	10 a.m.	37.0	98 6	
	1 p.m.	37.2	99.0	
	4 p.m.	37.5	99.5	
	7 p.m.	37.8	100.0	
October 22.....	7 a.m.	36.6	97.8	No injection.
	10 a.m.	36.8	98.2	
	1 p.m.	37 3	99.2	
	4 p.m.	36.5	97.7	
	7 p.m.	36.7	98.0	
October 23.....	7 a.m.	36.4	97.5	One injection.
	10 a.m	37.3	99.2	
	1 p.m.	37.5	99.5	
	4 p.m.	37.6	99.7	
	7 p.m.	37.8	100 0	
October 24.....	7 a m.	37.1	98 8	None.
	10 a.m.	37.4	99 3	Weight, 118 lbs.
	1 p.m.	37.7	99 8	
	4 p.m.	37.8	100 0	
	7 p.m.	37.0	98 6	
October 25.....	7 a.m.	36.7	98 0	One injection.
	10 a.m.	37 4	99 3	
	1 p.m.	37.6	99 7	
	4 p.m.	37 8	100 0	
	7 p m.	38.0	100 4	
October 26.....	7 a.m.	36 9	98 4	No injection.
	10 a.m.	37.0	98 6	
	1 p.m.	37 5	99.5	
	4 p.m.	37 3	99 2	
	7 p.m.	37.3	99.2	

Date.	Time.	C°.	F°.	Injections.
October 27.....	7 a.m.	36 8	98.2	One injection.
	10 a.m.	37.2	99 0	
	1 p.m.	37 5	98.5	
	4 p.m.	37.8	100.0	
	7 p.m.	38.3	101.0	
October 28.	7 a.m.	37.0	98 6	No injection.
	10 a.m.	37 1	98 8	
	1 p.m.	37.3	99.2	
	4 p.m.	37.6	99 7	
	7 p.m.	37.3	99.2	
October 29.....	7 a.m.	37 1	98.8	One injection.
	10 a.m.	37.3	99.2	
	1 p.m.	38.3	101.0	
	4 p.m.	38 2	100.8	
	7 p.m.	38.6	101.4	
October 30.....	7 a.m	37.3	99 2	No injection.
	10 a.m.	37.4	99 3	Weight, 120 lbs.
	1 p.m.	38 3	101.0	
	4 p.m.	37.0	98.6	
	7 p.m.	..	..	
October 31.....	7 a.m.	37.0	98 6	None.
	10 a.m.	37.1	98.8	
	1 p.m.	38.1	100.6	
	4 p.m.	37.9	100.2	
	7 p.m.	37.9	100.2	
November 1.....	7 a.m.	36.8	98 2	One injection.
	10 a m.	37.5	99.5	
	1 p.m.	37.7	99.8	
	4 p.m.	37.8	100.0	
	7 p.m.	38.3	101.0	
November 2.....	7 a m.	37.8	100 0	None.
	10 a m.	36 4	97.5	
	1 p.m.	37.4	99.3	
	4 p.m.	37.5	99 5	
	7 p.m.	37.6	99.7	
November 3.....	7 a.m.	36.5	97.7	None.
	10 a.m.	37.2	99.0	
	1 p.m.	37.6	99.7	
	4 p.m.	37.3	99.2	
	7 p.m.	37.5	99.5	
November 4.....	7 a.m.	36 7	98.0	One injection.
	10 a.m.	37.0	98.6	
	1 p.m.	36.9	98 4	
	4 p.m.	37.3	99.2	
	7 p.m.	37.5	99.5	
November 5.....	7 a.m.	36.7	98.0	None.
	10 a.m.	36 8	98.2	
	1 p.m.	37.0	98.6	
	4 p.m.	37.2	99.0	
	7 p.m.	37.6	99.7	

Date.	Time.	C°.	F°.	Injections.
November 6.....	7 a.m.	36.6	97.8	None.
	10 a.m.	37.3	99.2	
	1 p.m.	37.2	99.0	
	4 p.m.	37.0	98.6	
	7 p.m.	37.4	99.3	
November 7.....	7 a.m.	36.5	97.7	None.
	10 a.m.	36.6	97.8	
	1 p.m.	37.2	99.8	
	4 p.m.	37.0	98.6	
	7 p.m.	37.4	99.3	
November 8.....	7 a.m.	37.0	98.6	One, 0.1
	10 a.m.	37.1	98.8	
	1 p.m.	37.3	99.2	
	4 p.m.	37.2	99.0	
	7 p.m.	37.3	99.2	
November 9.....	7 a.m.	36.9	98.4	None.
	10 a.m.	37.0	98.6	
	1 p.m.	37.2	99.0	
	4 p.m.	37.6	99.7	
	7 p.m.	37.7	99.8	
November 10....	7 a.m.	36.9	98.4	None.
	10 a.m.	37.1	98.8	
	1 p.m.	37.2	99.0	
	4 p.m.	37.0	98.6	
	7 p.m.	37.2	99.0	
November 11....	7 a.m.	36.7	98.0	None.
	10 a.m.	36.9	98.4	
	1 p.m.	37.1	98.8	
	4 p.m.	37.1	98.8	
	7 p.m.	37.1	98.8	
November 12....	7 a.m.	37.0	98.6	One, 0.1
	10 a.m.	36.8	98.2	
	1 p.m.	37.2	99.0	
	4 p.m.	37.1	98.8	
	7 p.m.	37.3	99.2	
November 13....	7 a.m.	37.2	99.0	None.
	10 a.m.	37.1	98.8	
	1 p.m.	37.9	100.2	
	4 p.m.	36.8	98.2	
	7 p.m.	36.9	98.4	
November 14....	7 a.m.	36.6	97.8	None.
	10 a.m.	36.5	97.7	Weight, 124 lbs.
	1 p.m.	36.8	98.2	
	4 p.m.	37.2	99.0	
	7 p.m.	37.0	98.6	
November 15....	7 a.m.	36.8	98.2	None.
	10 a.m.	37.0	98.6	
	1 p.m.	37.0	98.6	
	4 p.m.	37.0	98.6	
	7 p.m.	37.3	99.2	

Date.	Time.	C°.	F°.	Injections.
November 16 ..	7 a.m.	36.8	98.2	None.
	10 a.m.	37.0	98.6	
	1 p.m.	37.3	99.2	
	4 p.m.	36.9	98.4	
	7 p.m.	37.4	99.3	
November 17....	7 a.m.	36.9	98.4	None.
	10 a.m.	37.0	98.6	
	1 p.m.	37.1	98.8	
	4 p.m.	37.4	99.3	
	7 p.m.	37.0	98.6	
November 18....	7 a.m.	36.8	98.2	None.
	10 a.m.	37.3	99.2	
	1 p.m.	37.3	99.2	
	4 p.m.	37.2	99.0	
	7 p.m.	37.0	98.6	
November 19 ...	7 a.m.	36.8	98.2	None.
	10 a.m.	37.3	99.2	
	1 p.m.	37.4	99.3	
	4 p.m.	37.5	99.5	
	7 p.m.	37.5	99.5	
November 20....	7 a.m.	36.9	98.4	None.
	10 a.m.	37.2	99.0	
	1 p.m.	37.5	99.5	T. B. very scarce, very degenerate, much smaller.
	4 p.m.	37.7	99.8	
	7 p.m.	..	..	
November 21....	7 a.m.	36.7	98.0	Two each of 1 cc. of 0.1 sol.
	...	..	..	
	...	..	..	
	...	..	..	Weight, 125¼.
	...	..	..	

Another case reported in the "Medicinische Wochenschrift" very similar in its course is also given. It is not, however, necessary to give the detailed temperatures of the other cases, as the two here reported, especially that of Weigt, will serve to show very clearly the variations in the temperatures due to the treatment.

It will be noticed under the cases that all the temperatures are given in Fahrenheit. We thought it better to translate all the Centigrade temperatures, as the Fahrenheit scale is much more suggestive to the English mind (and personally, I, E. F. G., prefer the Fahrenheit scale, since the actual degrees are a finer subdivision of temperature than the Centigrade scale, and the difference conveyed to the mind is greater

between 102° and 104° Fahrenheit than it is between 39° and 40° Centigrade, the same difference expressed by the Centigrade scale)

Pulmonary Phthisis.

CASE II.—A locksmith, aged 21 years. Family history good. In 1889, enlargement of cervical glands. Since the end of May expectoration and cough. From 30th September to 3d October, blood in sputum.

General Condition.—Fairly nourished, tall man, with flat chest. Dulness in front on the right side down to the second rib. Behind, in the right supraspinous fossæ, dulness. Numerous crepitations over the right lung. Expectoration colored; contains tubercular bacilli up to No. 6 on the Gaffsky table. Left lung free.

Date.	Time.	Temperature.	Remarks.
October 3.....	7 a.m.	98.4	
	10 a.m.	99.0	
	1 p.m.	99.0	
	4 p.m.	99.7	
	7 p.m.	100.6	
October 4.....	7 a.m.	100.0	Injection of 0.001, 9 a.m.
	10 a.m.	98.6	No blood in expectoration.
	1 p.m.	102.7	T. B. 5–6.
	4 p.m.	99.3	No rigor, no sickness.
	7 p.m.	100.9	
October 5.....	7 a.m.	99.5	Injection, 0.001.
	10 a.m.	99.5	
	1 p.m.	99.1	
	4 p.m.	99.1	
	7 p.m.	101.3	
October 6.....	7 a.m.	99.3	Do.
	10 a.m.	99.0	
	1 p.m.	99.1	
	4 p.m.	99.7	
	7 p.m.	100.9	
October 7.....	7 a.m.	100.2	Slight hæmoptysis.
	10 a.m.	100.8	No injection.
	1 p.m.	100.7	
	4 p.m.	102.2	
	7 p.m.	100.4	
October 8.....	7 a.m.	100.8	Injection, none.
	10 a.m.	100.4	
	1 p.m.	100.4	
	4 p.m.	100.4	

Date.	Time.	Temperature.	Remarks.
October 9.....	7 a.m.	98.4	No blood in sputum.
	10 a.m.	98.6	Injection 0.01, 9 a.m.
	1 p.m.	99.3	
	4 p.m.	103.8	No rigor.
	7 p.m.	103.6	
October 10.....	7 a.m.	100.2	Patient feels very weak.
	10 a.m.	99.0	
	1 p.m.	98.6	
	4 p.m.	97.9	
	7 p.m.	97.9	
October 11.....	7 a.m.	97.7	Injection, 0.01.
	10 a.m.	98.2	
	1 p.m.	98.8	
	4 p.m.	100.9	
	7 p.m.	100.4	
October 12.....	7 a.m.	98 8	Injection, 0.02.
	10 a.m.	97.5	No shivering, no rigor.
	1 p.m.	98.0	
	4 p.m.	103.8	
	7 p.m.	104.0	
October 13.....	7 a.m.	99.3	
	10 a.m.	99.2	
	1 p.m.	97.5	
	4 p.m.	98.0	
	7 p.m.	97.7	
October 14.....	7 a.m.	97.3	Injection, 0.02.
	10 a.m.	98.8	
	4 p.m.	100.2	
	7 p.m.	100.6	
October 15.....	7 a.m.	98.0	
	10 a.m.	98.4	
	1 p.m.	98.4	T. B., 5.
	4 p.m.	99.4	
	7 p.m.	101.8	
October 16.....	7 a.m.	98.4	Injection, 0.04.
	10 a.m.	99.0	
	1 p.m.	97.7	
	4 p.m.	98 6	
	7 p.m.	99.0	
October 17.	7 a.m.	97.9	
	10 a.m.	98.6	
	1 p.m.	98.4	
	4 p.m.	98.8	
	7 p.m.	99.5	
October 18.....	7 a.m.	98.2	T. B., 4.
	10 a.m.	97.8	Expectoration in 24 hours, 30 ccm. = ½ oz.
	1 p.m.	98.6	
	4 p.m.	97.7	
	7 p.m.	97.7	

Date.	Time.	Temperature.	Remarks.
October 19.....	7 a.m.	97.7	Injection, 0.06.
	10 a.m.	97.3	
	1 p.m.	97.5	Tubercle bacilli have disappeared.
	4 p.m.	98.4	
	7 p.m.	99.5	= T. B., 0.
October 20.....	7 a.m.	97.7	
	10 a.m.	97.7	
	1 p.m.	99.5	
	4 p.m.	99.6	
	7 p.m.	99.7	
October 21.....	7 a.m.	97.9	Injection, 0.08.
	10 a.m.	97.9	
	1 p.m.	98.2	T. B., 0.
	4 p.m.	99.0	
	7 p.m.	99.4	
October 22.....	7 a.m.	97.9	Injection, 0.09.
	10 a.m.	97.9	
	1 p.m.	99.0	T. B. numerous in caseous lupus.
	4 p.m.	98.2	
	7 p.m.	98.1	
October 23.....	7 a.m.	99.5	T. B. same as yesterday.
	10 a.m.	99.1	
	1 p.m.	98.8	
	4 p.m.	98.6	
	7 p.m.	98.4	
October 24.....	7 a.m.	97.9	T. B. same as yesterday.
	10 a.m.	97.9	
	1 p.m.	97.9	
	4 p.m.	97.7	
	7 p.m.	98.0	
October 25.....	7 a.m.	97.2	Injection, 0.1.
	10 a.m.	99.0	
	1 p.m.	97.7	T. B. same.
	4 p.m.	97.6	
	7 p.m.	98.6	
October 26.....	7 a.m.	97.9	Injection, none.
	10 a.m.	97.9	
	1 p.m.	98.1	
	4 p.m.	98.6	
	7 p.m.	98.2	
October 27.....	7 a.m.	98.0	Injection, 0.1.
	10 a.m.	99.5	
	1 p.m.	97.7	T. B. same
	4 p.m.	98.0	
	7 p.m.	99.0	
October 28.....	7 a.m.	97.5	Injection, none.
	10 a.m.	98.6	
	1 p.m.	98.0	T. B. same.
	4 p.m.	98.4	
	7 p.m.	97.9	

Date.	Time.	Temperature.	Remarks.
October 29.....	7 a.m.	97.3	Injection, 0.1.
	10 a.m.	97.7	
	1 p.m.	98.8	T. B. same.
	4 p.m.	98.6	
	7 p.m.	99.8	
October 30.....	7 a.m.	98.8	Injection, none.
	10 a.m.	98.8	
	1 p.m.	98.6	T. B. very few.
	4 p.m.	98.6	
	7 p.m.	99.0	
October 31.....	7 a.m.	97.4	Injection, none.
	10 a.m.	98.2	
	1 p.m.	98.6	T. B. disappeared.
	4 p.m.	97.9	= 0 in 20 cc.
	7 p.m.	98.4	Expectoration.
November 1.....	7 a.m.	97.5	Injection, 0.1 cc.
	10 a.m.	97.9	
	1 p.m.	98.3	T. B. very numerous.
	4 p.m.	98.3	
	7 p.m.	98.4	
November 2.. ...	7 a.m.	98.6	T. B. same.
	10 a.m.	98.6	
	1 p.m.	98.4	
	4 p.m.	98.6	
	7 p.m.	98.6	
November 3.....	7 a.m.	97.7	
	10 a.m.	97.6	
	1 p.m.	98.4	
	4 p.m.	98.6	
	7 p.m.	98.0	
November 4.....	7 a.m.	97.6	Injection, 0.1.
	10 a.m.	96.8	
	1 p.m.	97.7	
	4 p.m.	98.6	
	7 p.m.	98.6	
November 5.....	7 a.m.	99.0	No T.B.
	10 a.m.	98.2	
	1 p.m.	98.8	
	4 p.m.	99.0	
	7 p.m.	99.0	
November 6.....	7 a.m.	97.0	T.B. very scarce and very degenerated.
	10 a.m.	97.7	
	1 p.m.	98.4	
	4 p.m.	98.2	
	7 p.m.	98.0	
November 7.....	7 a.m.	97.7	T.B. disappeared.
	10 a.m.	98.0	Since 24th Oct. has gained 1¼ lbs. weight.
	1 p.m.	98.2	
	4 p.m.	98.0	
	7 p.m.	98.2	

Date.	Time.	Temperature.	Remarks.
November 8.....	7 a.m.	98.0	T.B. not present.
	10 a.m.	97.6	
	1 p.m.	98.2	Expectoration 10 cc.
	4 p.m.	98.8	

At the end of 35 days' treatment the condition of this case was as follows:

The dulness of the right side still noticeable. Crepitations very much diminished, only to be detected upon coughing. Blood was not again expectorated. Expectoration less, of glary transparent consistency. The night sweats had disappeared. Tubercle bacilli completely disappeared. Had gained 1¼ lbs.

CASE III.—Shoemaker, 20 years, good family history. Since Christmas, cough and expectoration. Hæmoptysis of lengthy duration.

Condition.—Weak, small man with unusual pallor. Right supraclavicular dulness. Left side dulness to second rib, over the dull areas numerous small fine crepitations. Profuse expectoration. Tubercle bacilli No. 6.

After 27 days' treatment there remained over both supraclavicular fossæ slight dulness. The dulness had completely disappeared over the left clavicle. On the right side crepitations entirely absent. On the left side they are still noticeable. General condition good. Cough only at night and morning. Expectoration markedly diminished, about half an ounce in the 24 hours.

Tubercle bacilli quite disappeared. A gain in weight of four pounds.

CASE IV.—Joiner, 28 years, hereditary consumption.

History.—For four years colored expectoration, debility, breathlessness. Was treated with creosote without improvement of symptoms.

Present Condition.—Small, fairly well-built man. Over both apices and on left side dulness to the second rib; crepitation especially on left side. Expectoration slimy, purulent, copious: contains tubercle bacilli, No. 4, Gaffsky.

After 32 days' treatment the condition was as follows:

At left apex, crepitation; at right, crepitation only after coughing; besides this, dulness over both supraclavicular

fossæ. General condition had greatly improved. The night sweats, which earlier had been very severe, completely disappeared. At first, loss of weight, afterward gain of ¾ lb. Expectoration diminished. Tubercle bacilli at one time entirely absent.

CASE V.—Shoemaker, 42 years, hereditary consumption. In 1868, hæmoptysis, since that time no reappearance. Four weeks ago suffered with stitch in side. For eight days, cough; since three days, hæmoptysis.

Present Condition.—Middle size, fairly strong man. Over both supraclavicular fossæ dulness; behind at the top of the right scapula, dulness with bronchial breathing.

After thirty days' treatment presented following conditions:

Over both supraclavicular fossæ, slight dulness. On left side at height of inspiration a few creptitations. The dulness and bronchial breathing at back of scapula disappeared. Cough only in the morning. Expectoration reduced to a minimum. Bacilli for many days entirely absent. Blood is no longer present in sputum. General condition good; three and one-third pounds increase in weight.

CASE VI.—Plaster-of-Paris grinder, aged 26, healthy family history. Since Christmas, cough and expectoration. Treated with creosote.

Present Condition.—Tall, lean man; in front right side dulness to second rib, innumerable minute crepitating râles, which are also to be heard at the left apex, although in this place there is no noticeable dulness.

Expectoration very copious, thick, slimy, purulent; contained tubercular bacilli No. 5.

After fifteen days' treatment very few crepitations; dulness on right side diminished. General condition good. Night sweats seldom, cough only troublesome at nights and in the early morning, very little during day. Expectoration had diminished to about one-third. Tubercular bacilli at same time quite absent; gained four and one-half pounds.

CASE VII.—Shoemaker, 44 years, of healthy family history. Summer of 1889 left-sided pneumonia. Since about five weeks breathlessness. Expectoration in the morning. Shortly before admission, hæmoptysis.

Present Condition.—Dulness in both supraclavicular fossæ,

on left side dulness down to second rib, râles, six days after admission hæmoptysis, expectoration pretty copious; contains tubercular bacilli No. 3.

After nineteen days' treatment, there is still dulness over both supraclavicular fossæ, especially left, over the left apex creptitations are still to be heard. Expectoration very scanty. Tubercular bacilli quite disappeared. Increase of weight, one and one-quarter pounds. Patient discharged at his own request.

CASE VIII.—Saddler, 28 years of age, hereditary consumption. A year ago left-sided inflammation; seven weeks ago right-sided inflammation of lung, since this time slight cough, great expectoration. Shortly before admission the expectoration was tinged with blood.

Present Condition.—Rather weakly man. Right front over the clavicle slight dulness, a few crepitations. Expectoration slimy, somewhat tinged with blood; contained tubercular bacilli No. 3.

After twenty-eight days' treatment, there was still present over the clavicle on right side diminished percussion note. Crepitations absent. Cough only mornings. Expectoration very sparse; in twenty-four hours less than half an ounce.

CASE IX.—Tubercular bacilli almost entirely absent. Night sweats still present, though less intense. General condition good. Gain of weight, three pounds.

A *résumé* of these cases gives a general improvement. It is true that cases of phthisis do improve when taken into a hospital and put under careful treatment, but apart from the improvement we should expect from the amelioration of environment, there is the absolute diminution in number of the bacilli, the alteration in the character and amount of the sputum, the cessation of the night sweats, the absolute clearing up of the previously existing dulness, and the disappearance of the crepitations. This alteration in the physical condition of the patients leaves no doubt as to the potency of the injection.

An interesting fact may be noticed in the temperature of the reaction. When a general view of the same is taken, for where a reaction has failed to set in within the usual period during which the reaction is effected it very often becomes

manifest in a modified degree on the following or even the second day after the injection has been made, at about the same hour of the day that it should have occurred, this is noticeable on following days: 5th November in Case II.; 7th October, Case II.; these cases show the retarded reaction. In case of Weigt, 4th October, 30th September, 28th September. The rise in temperature appearing to take place in the form of waves.

So far the deaths have not been very carefully reported, but the following case will serve to show how fatal results may occur; the details were very much as follows: The patient, an advanced case of phthisis with cavities, was taken in with a temperature of about 102°. Injection was made, the temperature went up over 106°, and was followed by a fall to 95°, when fatal collapse set in, and the patient died. Owing to an unfortunate accident no post-mortem examination was made upon this case.

The other cases of advanced phthisis were not reported in full.

Lupus.

We will now report one case of lupus *in extenso*, the action of the injection upon surgical cases being so simple as compared with the changes in the lung cases that we do not consider it necessary to burden a small work of this character with unnecessary repetition. This case is taken from a published report by Drs. Köhler and Westphal. The case was exhibited both at the hospital and at the meeting of the Medical Society of Berlin.

Max Theiss, merchant, age 28 years, who had been under treatment at the Charité for lupus of the nose, upper lip, chin, and cheeks, was first troubled six years with a tubercular and pustular eruption on the upper lip, which upon surgical treatment was apparently relieved. After six months the eruption appeared again at the same place, also upon the nose. Notwithstanding continued treatment the process continued to increase upon the nose. By its increase the whole nose, with the exception of the bridge, had undergone lupous degeneration. The alæ of the nose partly destroyed on both cheeks,

and beneath the chin were lupous spots about the size of a sixpence.

On the 28th November, 1889, also on the 18th April, 17th June, 9th July, and 18th August of this year, the tubercles and infiltrated spots were cauterized, and afterward treated with balsam of Peru.

On the 10th of October, 1890, the mischief was in a very active state, the infiltration encroaching upon the septum, spots were present beneath the skin and upon the left side of the mouth.

On the 12th October, 10:45 A.M., an injection of 1 c.c. of one-per-cent solution was made in the usual place. At 1 P.M. a feeling of heat, burning, and swelling of the face, followed immediately by rigors, the nose being at the same time injected and swollen. At 4:30 P.M. the whole face was suffused. The nose and other affected spots severely swollen, of a dark red color, likewise the skin immediately beneath the eyes. Upon the lower half of the nose, the middle part of the upper lip, the spots on the cheeks, and under the chin then appeared a yellow exudation, which now dried to a crust. Neck and trunk covered with a scarlet exanthematous rash. Complained of headache and feebleness, loss of appetite, and furred tongue. The pulse, 120 to the minute, full, high, and fairly strong. Temperature 104°.

On 13th October the face was still red and swollen, and the scab had formed. Headache and dyspepsia less marked; tongue still furred, pulse 96, fairly good. The exanthema still present. The temperature sank to between 100° and 102°.

14th October.—The appearance of the face the same as yesterday, the exudation in greatest part dried. Temperature sank between 98° and 99.5°.

15th October.—The congestion of the face going off; the exudation everywhere dried into a solid scab. Upon the bridge of the nose and at the upper parts of the scab the skin seemed to be somewhat drawn in and lying in fine folds parallel to the bridge of the nose. Highest temperature, 99.0°.

17th October.—The congestion of the face has subsided, except upon the nose, the upper lip, and the cheeks, where it is about the same as on the day of injection. The spots on the right cheek have lost their scab, with the exception of a small

flake in the centre; in isolated spots upon the nose and upper lip the crusts have begun to break off.

18th, 19th October.—No perceptible alteration. Temperature normal, appetite and general condition good.

20th October.—Redness and swelling of the face the same. The scabs upon the upper part of the nose and the spot on the right cheek allow themselves to be easily removed. The bridge and point of nose appear smooth and light red, covered with young and tender scar tissue; on the upper part of both alæ, together with the edges, are pale granulations. The red spot upon the left cheek, except a small spot the size of a pin's head, shiny and flat.

21st October.—The scarring upon the nose has made further progress, the edges of the alæ still granulating. The scab of the upper lip separating. The upper lip in greater part shiny, and covered with fine skin.

24th October.—Lip completely covered, the nose and the spots covered with white specks.

5th November.—The nose in general of a pale red color, and surrounded at the sides with a one centimetre wide band. The little spots upon the nose were disappearing. The general condition so far was good, and the temperature either normal or subnormal.

7th November.—1 P.M., injection of 1 c.c. one per cent solution in usual place; at 4:30 goose-skin over the whole body; pretty severe rigor, the nose redder than before the injection; tongue not furred; headache; pulse 120, high, fairly strong tension; at 5:30 complains of incontinence and a feeling of increased tightness in face, which is flushed. Swelling and congestion of the nose and remaining lupous spots. At the same time red exanthematous eruption upon the trunk. The shivering lasted half an hour, and was followed by a hot stage. Temperature at 8:30, 104.4°.

8th November.—Nose, upper lip, the spots upon the lips, cheeks, and under the chin still fairly flushed and swollen. The swelling not so great as after the first injection, upon nose and upper lip again the yellow exudation, which covered the whole of the red surface, not nearly so copious or so viscous. Upon the flakeless part of the lupous nose small white pustules; nasal aperture not closed. The healthy nose root very slightly injected and free from scurf. During the night the

temperature subsided to 101.2°. The highest temperature to-day, 102.0°. Pulse 96. Headache, depression, etc. Eruption subsiding.

9th November.—Face as yesterday. Urine brown red. Urine with yellow foam, free from albumin. The nose and face still decidedly redder than before the second injection, but still paler than yesterday. Scales upon the upper lip and nasal apertures. The spot on the right cheek, the one beneath the chin, and the one on the right cheek covered with white heaped-up branny scales.

10th November.—Morning temperature, 97.7°; 9:45 injection of 1 c.c. one-per-cent solution. Rigor at 12; duration one hour. The temperature reached 104° at 4 P.M., and fell by the next morning to 97.4°. At 5 P.M. there is no alteration in appearance of the face. On breast and back a macular eruption. No headache. Pulse 120, high and full.

11th November.—Local condition as yesterday, perhaps the redness of face is less than yesterday; the scales still adhere. Upon the remaining red parts white flecks. Rash disappeared. To-day the temperature did not reach 98.8°.

12th November.—Nose and face paler than yesterday. 9:45, injection of 1 c.c. one-per-cent solution. At 12:15 slight rigor lasting one hour, after which, feeling of heat. At 2 o'clock a feeling of swelling in face complained of. No alteration in appearance of face at 5:30. The nose, with exception of its base, for a breadth of three centimetres strongly swollen, redder and denser than yesterday morning. Urine dark red-brown, free from albumin, Gmelin's test evolved nothing. Temperature at 3 P.M. reached 103°, and fell by next morning to 97.2°, and has remained subnormal since.

Urine dark red-brown, free from albumin. The nose and surroundings paler than yesterday, and less swollen. The scales remain firm.

14th November.—The redness and swelling have subsided still more, but were still undoubtedly more marked than was the case previous to the second injection. A strong discharge of pus was taking place from the lupous parts. In order to protect the young tender skin from infection by the pus, a compress of permanganate of potash was applied and the nose smeared with boracic vaselin. The patient until now had received 4 c.cm. of the one-per-cent solution, that would be 0.04 c.cm. of the undiluted preparation.

The above-quoted case gives a very good representation of the course of the treatment, and is a very typical case. There have now been some hundred or perhaps more cases of lupus treated, in all which the course pursued has been practically the same.

Cases of Tubercular Laryngitis.

Four cases, under Prof. Bergmann:

(1) *Kegel*, 28 years old, suffered one and one-half years from feverishness and cough, probably old case of fibroid phthisis; dulness on both sides of the back down to angles of scapulæ; in front in right side to second rib; left down to clavicle; interarytenoid ulceration and infiltration over the arytenoid cartilages.

Injection of 0.01 lymph—

T. before injection,					97.8°
T. 1 hour after, *i.e.*, at	1	o'clock,			99.2°
T. " "	5	"			101.0°
T. " "	7	"			102.6°
T. " "	9	"			103.5°

At 9 o'clock the neighborhood of the ulceration was intensely swollen and inflamed, as in acute inflammation.

(2) *Gendrich*, 42 years; three years consumptive; feverish for three weeks; advanced consumption in both lungs; ulceration and erosion of left vocal cord.

Injection of 0.005 lymph.

T. before injection,					98° F.
T. after "		at 1	o'clock,		99.5° F.
T. " "		at 5	"		99.7° F.
T. " "		at 7	"		99.8° F.
T. " "		at 9	"		102.0° F.

Intense congestion in neighborhood of ulcer; left vocal cord much swollen.

(3) *Nelske*, 27 years; three years consumptive. Both apices infiltrated, reaching at back as low as spine of scapula, in front down to clavicle. Diffused submucous laryngitis. Epiglottis, and ary-epiglottic folds strongly infiltrated. Ulceration of both vocal cords.

Injection of 0.005 lmph.

T. before injection, ... 98.6° F.
T. after " at 1 o'clock, . . 99.5° F.
T. " " at 3 " . . . 100.4° F.
T. " " at 5 " . . . 104.0° F.
T. " " at 7 " . . . 105.6° F.
T. " " at 9 " . . . 103.8° F.

Epiglottis rather more swollen; laryngeal mucous membrane pale throughout and unaltered.

(4) This case had been already for some little time under treatment.

Wussow, 31 years, nearly two years consumptive. Hardly appreciable apical affliction. Slight ulceration, and polypoid growth in the anterior angle of the glottis, and on the borders of the epiglottis.

Injection of 0.2 c.c. one-per-cent solution = 0.002 on November 10th, 1890—

T. before injection, ... 98.0° F.
T. highest arrived after injection, . . 104.2° F.

November 11th—

Slow subsidence of temperature.

November 12th—

Injection 0.02 lymph.
T. rose to . . . . . 100.8° F.

November 13th—

Normal temperature. Patient during the night expectorated a slough derived from the larynx. Microscopic examination revealed the giant cells found in tuberculosis.

November 14th—

Injection of 0.03 lymph.
Evening temperature, ... 101.2° F.

November 15th—

Temperature normal.

November 16th—

Injection of 0.04 lymph.
Evening temperature, ... 101.6° F.

A case of carcinoma of the larynx was injected with 0.01 lymph; therefore, more than twice as strong a solution as the patients Gendrich and Nelske were subjected to. No fever;

generally health undisturbed. Temperature did not rise above 97.8° F. (*Note.*—It appears that the average normal temperature in Germany is somewhat lower than in England.—E. F. Grün.)

This last shows the value of the injection as a means of differential diagnosis, say, between tuberculous disease of larynx on one hand, and syphilitic or cancerous on the other.

It would be impossible to describe all the foregoing 21 cases, which are at present under treatment, within the compass of this small work. Therefore, we select a few of the most typical, as follows:

No. 1.—Anna T., 23 years, under treatment of Dr. William Levy. Has suffered since her fourteenth year with bone abscesses (osteomyelitis). After one of these abscesses in the neighborhood of the shoulder-joint, for a long time there remained a fistula, from the margin of which lupus developed, and in the course of three years this latter spread over the whole of the left arm, over the front and back of the neck, and over the greater portion of both cheeks, a really terrible case. On reception of the patient at the hospital the left arm was intensely swollen, the skin in the bend of the elbow was alone unaltered; the rest showed by its serpiginous scars evidence of severe pre-existent lupus. There was no elevation of temperature. On October 8th, at 10 o'clock, one per cent of the solution was injected. After a few hours, preceded by a rigor, an elevation of temperature occurred, which at 3 o'clock had reached 105.2° F., the patient being insensible and delirious. Coincident with the rise of temperature the arm and afflicted portion of the skin became intensely swollen, till the left arm had reached a considerable circumference, the hand being œdematous. The scars were little altered, but where even the smallest lupus tubercles were visible these were surrounded by a broad, dark red zone, and through these dark red spots it was easily possible to discover where tuberculous matter still existed. Still more changed were the tubercles on the forearm and the back of the hand; they were intensely swollen and of a dark blue color. An incision into these latter showed that the lupus growth extended through the entire thickness of the skin, and had an appearance of dried blood-clots. The

arm was suspended in a Volckmann's splint. The eruptions on the arm, hand, and face quickly dried up, and were soon covered with the "Brandschorfen" (slough produced by actual cautery) appearance, as if they had been cauterized. The slough came away after eight days. The patient remained from now on feverless, and it was hoped that healing would ensue from this one injection.

On the 27th October, at 10 A.M., another injection was made. The consequences were not so intense, but still very severe. The temperature again rose to 104° F., with delirium, the lupus tissue swelled up, and the scars in the places also became swollen and congested; this time, however, no necrosis took place. On the 5th and 6th of November injections were again made; the temperature rose to 105.8° F.; next time it rose to 105.0° F., but the swelling was much less. The injections will be repeated at short intervals, *i.e.*, every other day, and as soon as the patient no longer reacts to 0.1 lymph, the strength will be gradually increased to 1.0 or the saturated. At the time of writing the patient remains in about the same condition as after injection No. 2.

No. 2.—Willy Siegelsdorf, 3 years old; left-sided hip disease existent already some weeks; slight abduction and flexion.

I. Injected lymph 0.001, 6th November.

T. before injection, ... 98.8° F.
T. highest after injection, . . . 104.0° F.
T. became normal, 7th November.

II. Injected lymph 0.001, 8th November.

T. highest after injection, . . . 100.8° F.
T. became normal, 9th November.

III. Injected lymph 0.001, 10th November.

T. highest after injection, . . . 103.6° F.
T. became normal, 11th November.

IV. Injection same, 12th.

T. highest, ... 102.4° F.
T. normal on 13th.

V. Injection same, on 14th.

T. highest, ... 101.2° F.
T. normal on 15th and 16th.

Notes:—General improvement. At present time only

slight impairment of movement. Leg can be completely straightened.

No. 3.—*Tylizki*, 2½ years old. Right hip disease, eight weeks. Severe adduction, flexion, and swelling. Five injections were made as in foregoing case, the temperature each time returning to normal, and the highest temperature being 105.2° F.

Notes :—General reduction of swelling and pain; both remain in modified amount. Condition of limb unaltered. Probably separation of epiphysis.

No. 4.—*Oscar Schleusmer*, 6 years old, one and one-half years right hip disease. Intense flexion; adduction; luxation; large abscess under gluteal muscle; five injections of 0.002 lymph usual effects. Highest temperature, 102.6°.

Notes :—Very slight improvement. (Not more than might be accounted for by the rest in bed.—E. F. G.)

No. 5.—Tubercular gonitis with abscess, one year's duration, age 23. Four injections; severe reaction; temperature rising to over 105° after each injection.

Notes :—Knee showed after each injection an increase of pain and swelling, which quickly disappeared and left slight improvement. The knee is now much less swollen than at the commencement of the treatment, but still painful, and the abscess remains.

Case of Ankle-Joint Disease under Drs. Köhler and Westphal.

The 18-year-old Leonadia Spichalski has presented herself at this department since the 28th May, 1890, concerning an inflammation of the right ankle-joint, which commenced without obvious reason about December of the previous year, and which had continued with occasional remissions. The joint on admission was considerably swollen, so that the malleoli were not so prominent as in the other foot. Passive movement was intensely painful. The only treatment adopted was to inclose the foot in plaster-of-Paris.

On the 11th October around the malleoli and over the ankle-joint the foot was extensively swollen. The swelling was most marked on the inner side of the tendo Achillis. The skin of normal color and not œdematous below the inner malleoli. Fluctuation and bluish discoloration of the skin which

had earlier been more or less existent. Active movement of the foot greatly restricted. The attempt to perform passive movement produced great pain. Circumference of the foot across the ankle and around the heel 10.8 inches. Diagnosis, tubercular ankle-joint disease.

CASE.—*Leonadia Spichalski.*

Date.	Time.	Temperature.	Remarks.
October 11.....	10:30 and 11 a.m.	98°.6	Injection 1 c.c., one-per-cent solution. Foot inflamed and tender.
	2 p.m.	99.3	Circumference of foot 7 p.m. 10.92 inches.
	4 p.m.	102.0	
	7 p.m.	103.8	
October 12.....	7 a.m.	100.4	Injection of 0.2 c.cm.
	10 a.m.	99.5	Swelling of foot.
	1 p.m.	99.5	
	4 p.m.	101.4	
	7 p.m.	102.0	
October 13.....	7 a.m.	99.5	Injection of 0.2 c.cm.
	10 a.m.	100.2	
	1 p.m.	99.2	
	4 p.m.	99.7	
	7 p.m.	99.0	
October 14.....	7 a.m.	99.0	Injection of 0.3 c.cm.
	10 a.m.	98.8	
	1 p.m.	98.6	
	4 p.m.	100.4	
	7 p.m.	104.4	
October 15.....	7 a.m.	97.0	
	10 a.m.	96.8	
	1 p.m.	98.4	
	4 p.m.	97.5	
	7 p.m.	97.2	
October 16.....	7 a.m.	98.6	Injection of 0.3 c.cm.
	10 a.m.	98.0	
	1 p.m.	97.6	
	4 p.m.	101.3	
	7 p.m.	104.2	
October 17.....	7 a.m.	98.6	
	10 a.m.	97.9	
	1 p.m.	97.7	
	4 p.m.	97.4	
	7 p.m.	..	
October 18.....	7 a.m.	97.4	Injection of 0.04 c.cm.
	10 a.m.	98 8	
	1 p.m.	99.0	
	4 p.m.	104.0	
	7 p.m.	103 8	
	7 p.m.	98.2	

Date	Time	Temperature	Remarks.
October 19.....	..	Temperature remained at 97.7	
October 20.	..		
October 21.....	7 a.m.	97.5	Injection of 0.05 c.c.
	10 a.m.	97.2	
	4 p.m.	103.8	
	8 p.m.	104.4	
October 22.....	7 a.m.	98.6	
	10 a.m.	97.2	
	1 p.m.	98.4	
	4 p.m.	98.6	
	7 p.m.	98.4	
October 23..	7 a.m.	98.0	Injection of 0.5 c.c.
	10 a.m.	99.3	
	1 p.m.	98.6	
	4 p.m.	101.3	
	7 p.m.	102.0	
October 24...,...	7 a.m.	97.5	
	10 a.m.	97.6	
	1 p.m.	97.8	
	4 p.m.	97.8	
	7 p.m.	98.0	
October 25.....	7 a.m.	97.3	Injection 0.5 c.c.
	10 a.m.	97.2	
	1 p.m.	97.7	
	4 p.m.	99.8	
	7 p.m.	100.2	
October 26.....	7 a.m.	97.3	
	10 a.m.	96.8	
	1 p.m.	98.6	
	4 p.m.	98.6	
	7 p.m.	98.4	
October 27	7 a.m.	98.2	Injection 0.6 c.c.
	10 a.m.	98.4	8th Nov. 0.1.
	1 p.m.	98.6	11th Nov. 0.2.
	4 p.m.	99.0	13th Nov. 1.0.
	7 p.m.	99.5	
October 28.. ...	7 a.m.	98.6	
	10 a.m.	100.4	
	1 p.m.	101.2	
	4 p.m.	100.6	
	7 p.m.	100.4	After this time, temperature subnormal and imperfectly recorded.
November 13	..	..	Injection 1.0 c.c.
	7 a.m.	97.7	
	10 a.m.	96.9	
	1 p.m.	99.5	
	4 p.m.	102.0	

This case, which shows the variations of temperature very well, and also underwent considerable local reaction, did not, however, as long as the observation has so far been possible, show any very great improvement, although certainly the total swelling of the foot was slightly diminished, but the fluctuation and pain were still present, also the fixation of the joint was unaltered, so that this case cannot be considered an example of curative treatment.

Tubercular Gland Cases.

10th November.—10:20, injection of 1 c.c. of one-per-cent solution. Temperature before injection, 98.2°. Temperature, 9 P.M., 105°.

12th November.—10:35, injection of 1 c.c. of one-per-cent solution. Temperature before injection, 99°. Temperature, 9 P.M., 103.8°. Next morning temperature normal.

14th November.—10:20, injection of 1 c.c. of one-per-cent solution. Temperature, 99.2°. 3 P.M., 101.8°. 9 P.M., 97.8°.

After the first injection the glands became very painful, and one gland was slightly, though distinctly, enlarged. Afterward the swelling subsided. At present date, November 20th, the glands are all distinctly smaller than at the commencement of the treatment.

The first injection produced a bright red papular exanthema of the neck, shoulders, upper part of chest, and back, which reappeared after each injection.

Tubercular Gland Enlargement.

Three cases given:

1. Anna Genkow, 13 years old.
2. Frieda Sander, 7 years.
3. Anna Harmuth, 21 years.

Case I.—Has suffered three years with enlarged cervical glands, which very gradually swelled to the size of a walnut, and now form a mass as large as the fist, in the submaxillary, and lateral cervical region. Temperature before injection, 99.2°; after injection, evening temperature 104.4°. The glands were greatly enlarged. Still under observation.

CASE II.—Frieda Sander, undoubted scrofulous diathesis, blepharitis (an eczema of the margin of the lids), photophobia, scrofulous rhinitis, and eczema narium, lymphadenitis of cervical glands. Nothing perceptible in lungs. Injection of 0.2 c.cm. of one-per-cent solution.

CASE III.—Anna Harmuth, 21 years, anæmic tailoress, for two years swollen glands over the collar-bone, a number of swollen cervical glands at the hinder margin of the sterno-mastoid and angle of the jaw on both sides; the largest gland was of the size of a hen's egg.

6th November.—10:30 A.M., injection of one-per-cent solution. Temperature 98.8°; evening, 104.4°.

7th November.—Temperature normal.

8th November.—1:20 P.M., injection of 1 c.c. one-per-cent solution. Temperature before injection, 98.8°. After injection, 104.6°. Next morning, 99.5°.

Anna Gutschmidt.—Twenty-one years. (This case was exhibited at the Medical Society by Dr. Köhler.) Patient presented herself on the 24th September, 1890, with a lymphatic swelling under right lower jaw. Glands were extirpated on the 27th September. Wound healed in fourteen days. She had on the neck marks of former lymphatic abscesses. Her condition on the day of first injection was as follows: Left side of neck, several very large scars, extending from beneath right ear forward. On October 23d, 1 c.c. of one-per-cent solution was injected, 9 A.M.; at 4 P.M. rigor took place, and immediately afterward headache, backache, and pains in the joints. By evening, scars, with exception of the last one formed, were inflamed and swollen. On the back there was a red papular rash; temperature rose to 103°. The congestion of the cicatrices subsided during the course of following day. On the 29th they had assumed their original condition. Before, on the 26th, a severe pericorneal inflammation of the right eye took place, and on the 27th a small central opacity of the cornea was observed, and a small ulcer in the inner and lower divisions of the cornea. Under treatment with atropine the condition improved until the 10th of November, when, after the eighth injection, a sudden and complete coloration of the conjunctiva took place. This injection of the 8th of November, which was made at 4:30 P.M., was followed late in the evening by a rigor, and an elevation of temperature, which reached its

maximum, 102°, on the following morning at 10 o'clock, and gradually fell, till, on November 11th, it was subnormal. On the 9th November the scars, with the exception of those under the right lower jaw, were greatly swollen, red, and painful. On the 12th November the swelling had subsided. On the 13th, at 10:45 A.M., another injection 1 c.c. one-per-cent solution was made; at 1:45 P.M. a rigor; second rigor at 2:15 P.M., and intense stomach-ache; at 5:15 P.M. the tongue became coated with a thick gray fur; loss of appetite, pains in back and joints ensued; pulse 144°, soft and small. Scars on neck very much swollen and inflamed, except those under right lower jaw; pains in the larynx, incessant cough, with foamy, slimy expectoration, inflammation and swelling in the tonsils and the pharynx. Temperature at 7 P.M. 104°. Subsided by next morning. On the 14th November the above symptoms continued, but not so intense. The corneal ulcerations remained about the same.

PART VI.

RÉSUMÉ AND REMARKS.

WITH regard to the histories of the cases, notwithstanding the credit due to the German physicians in the carrying out of Koch's treatment, their histories of the cases leave much to be desired from the standpoint of an English clinical clerk, especially in the physical signs recorded, which are unfortunately very sparse in the Charité records. Again, the unfortunate fact that no temperatures are taken during the night, deprives the cases of almost half their clinical interest. Possibly, conceding the enormous number of patients in the Charité, it would be impossible to take all their temperatures, still the temperatures of selected cases should certainly have been observed continuously for the twenty-four hours. (I attempted to get the night temperatures, but found it was impossible.—E. F. G.) These considerations lead us to believe that, great as is the honor due to our honorable and friendly rivals, yet we think that if the profession will only awake to the vast importance of the discovery, and the hospitals of London and the universities afford proper facilities for instruction in bacteriology, we yet hope to hold our own in medicine! At present the profession suffers from the restraint of a foolish Act of Parliament passed during the progress of a wave of sentimentalism, which is a laughing-stock to the rest of scientific Europe, and which must, as long as it remains in force, hang like a millstone around the neck of the experimental physician. It is by no process of slow development and technical training that men can be educated into the rank of genius. The instinct of research is often present in the man widest removed from technical training schools. If he is fettered in the carrying out of experiments, the idea of which is but momentarily presented to the mind, and which, if not acted upon,

does not again recur, is lost forever. How can such a man wait to carry out his researches at a licensed laboratory with all its red-tapeism and osbstacles to deter and mortify?

With regard to comparisons between Koch and Jenner. All honor to both, but the difference in their discoveries lies in the fact that with Jenner the discovery was purely accidental. With Koch, on the contrary, the discovery has been synthetical, arrived at by the laborious putting together of isolated facts, the carrying out of prolonged and tedious experiments, in most cases extending over months and almost years. The fruit of Koch's discovery, I think, all will allow to be greater than that of Jenner's, for whereas in the former all must allow its value, with regard to the latter, there are, unhappily, still a few antivaccinationists in this country.

One would imagine that there might, on microscopical examination of the sputa, or other diseased products of patients who had been considerably benefited by the treatment, be observed a change in the appearance of the bacilli themselves owing to the action of lymph, and this is indeed the case; the bacilli are observed under the above circumstances to be thinner, broken up, bent, scattered, and otherwise degenerated. It might not be out of place here to say a few words about the examination of microscopical preparations of the bacillus. In cover-glass preparations of ordinary tubercular sputum, a lens such as a Zeiss' D or DD, or a good English one-sixth, is powerful enough, as a rule, if the examination be carefully made; but for sections and for the examination of pus, or sputum, containing these degenerated bacilli, an oil immersion lens is absolutely essential. Abbe's condenser should always be used in the examination of stained bacteria, with open diaphragm. For the convenience of persons desiring to purchase microscopes in consequence of reading this treatise, we would direct them to Baker, 244 High Holborn, who not only makes bacteriological microscopes, but sells those of Zeiss, Lietz, and a very good and cheap one-fifteenth oil immersion lens of Reichert, at the catalogue prices of these makers. All apparatus necessary for bacteriological work may be purchased from T. E. Becher and Co., of Hatton Wall, which firm also supplies Reichert's microscopes. The latest form of Koch's syringe, which is very neat and easy to sterilize, and also cheap, is supplied in a case at 5s. by Engelmann

Charlie Strasse, Berlin, who also supplies other apparatus of the lighter kinds for microscopical purposes.

In conclusion, we beg to apologize for any imperfections in this unpretending handbook, and believe that when we state that it has only been compiled in forty-eight hours from our notes which we brought back two days ago, that this, together with the fact that the book will have been compiled, printed, and in the hands of the reviewer four days after our return from Berlin, will be accepted as an excuse for any minor defects in style or text.

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